HEALTH AND EFFICIENCY

BY

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FORMERLY

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Published by
WYNKOOP HALLENBECK CRAWFORD COMPANY
80 LAFAYETTE STREET
NEW YORK
1922

Wynkoop Hallenbeck Crawford Company
Printers and Binders
New York

Dedicated in filial affection to my father and mother, whose teachings in early years impressed upon their children the way of life, and from whom they inherited health and strength, and who gave them the opportunity of a liberal education.

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PREFACE

Much repetition will be found upon the following pages. This has been deemed necessary in order that a lay reader may intelligently follow the subject.

Very little reference is made to alcohol, tobacco, or venereal disease and sex questions. The passage of the 18th Amendment makes education on the subject of alcohol the duty of the state. For the law can never be enforced until the citizens in general believe that the making of such a law was necessary. Were I to talk of the evils of tobacco no one would listen; and literature upon all sex questions can readily be obtained from departments of health, or societies which deal exclusively with such matters.

The subjects that I have selected seem to me of equal if not greater importance than these. Other subjects, such as the care of the skin, will be found to be practically covered in the various chapters.

The matter herein contained is the result of personal experience in practice, of observation in clinics and hospitals, and of long study. Much of the material has been given as advice to patients over a period of years.

It also forms, as I conceive it, the basis of welfare work in industry; since the primary object of such work is to give the worker an opportunity to care properly for himself. In this book are given the reasons for the installation of ample facilities for this purpose, such as the washing of hands, shower baths, to be used at the end of the day's work, wholesome drinking

water, attractive lunchrooms with good food and a balanced ration, toilets, proper lighting, heating of work-places in winter and their cooling in summer, the removal of dust, gases and fumes, sleep and recreation, and the many other things necessary to the maintenance of health. In other words, this book presents the reasons for, and the application of, the principles of physiology to the human machine in everyday working and living conditions. It is written also, partly as an ancestral obligation to some of those hardy pioneers who in the early years of our country helped to build for future generations.

Without mentioning names, so that no one else may be held responsible for any opinions expressed herein, I desire to thank all those who have patiently read my manuscript and who have made helpful suggestions.

Thomas Darlington,
27 Washington Square North,
New York City.

March, 1922.

PROLOGUE

This book goes forth not to cure disease, but to help prevent it.

With the war came a riot of expenditure, of time, of money, and of lives. War means waste. To save is now the watchword that is passed along the ranks of the combatants. Now must we fight spendthrifts.

Often have I sat at the bedside of a once strong man laid low with disease, perhaps never to be the same again, perhaps never to rise again. He was his own enemy, squandering his inheritance of Health and Strength, those priceless treasures which nature had intended to bring joy and happiness not alone to himself but to others.

Chapter I

IMPORTANCE OF HEALTH

This book has been written in the hope that it may serve to teach simple truths about the care of our bodies. It aims to reach many who have not now the knowledge of how to live, and to awaken and increase the interest of those who possess it. For it is the experience of all physicians that few people know how to take care of themselves, and that still fewer take heed until they become ill, perhaps past all hope of recovery. Then "all that a man hath will he give for his life." Few of us ever stop to think that sickness can come to us.

The consequences of ill health may affect not only ourselves, but others. If a disease is communicable, we may give it to others. In the case of the wage earner on whom depend wife, children and perhaps others, the consequences may be far-reaching, even unto the third and fourth generation. Many a parent dies from some preventable disease while yet young. The result is that his children must leave school early; the boy to earn money to support himself and family, and the girl—how difficult is her road, and how few her chances!

Besides this, efficiency depends primarily upon health, and upon one's efficiency depends one's earning capacity.

To be well is of first importance in our lives. It is important for our happiness and prosperity as indi-

viduals and as citizens. It is important for the state. The wealth of a nation does not consist in money only. Health is wealth. It is our greatest asset. Health is the first requisite of a soldier. Many impaired human machines were recently rejected by our draft boards. The reserve power of the nation depends upon the ability of men and women to endure stress and strain. No nation is stronger than the men and women who compose it. Production and mental and moral attainments are all more or less dependent upon individual health.

The greatest cause of poverty is sickness. Sickness is an expense both in loss of time and in money. It is an expense to maintain clinics, hospitals, sanatoria, health boards and poor houses—for most of those in almshouses have come there directly or indirectly through illness.

Consider the loss of time from work and the cost of the care of the more than four millions of sick persons who annually pass through the hospitals of the United States. Fully one-half of these cases of illness are preventable.

Consider the cost of illness among school children. Education is compulsory. Every child must go to school. The expense of maintaining a school is paid for out of taxes. Taxes are paid by all. If not directly they are paid for indirectly, as in rent. On account of illness many children lose place in their classes, are not promoted, and so must repeat a year. This is a loss of time and also costs money; the cost of teaching and overhead—heat, light and interest. Children who are not promoted occupy seats which should be occupied by the incoming and younger scholars. For this reason, more classrooms and more schools are needed.

This also costs money. Without sufficient school houses many must be put on part time. This lengthens the time a child must stay in school. And if a child dies at the end of the school period, all the investment in the education of that child is lost.

There are certain things that have always been necessary to the life of human beings: food, shelter and clothing. To have and enjoy these things we must work for them. We cannot work if we are sick. Consider also the cost of illness in industry. Here are several losses: the direct loss of wages by absence from work; diminished efficiency before total recovery resulting in diminished production and poorer work. As sickness often necessitates substitutes, the result is much spoiled material and inferior workmanship. Statistics collected by those in position to do so properly, show that sickness is one of the most important, if not the greatest cause of unemployment; and these statistics also show that in some places as many as thirty per cent. of those who become ill are heads of families. Many millions of dollars are thus lost in industry through illness.

Still further, how many young married couples start out in life full of hope in an effort to purchase or build and own their home. For days and weeks they have planned to buy a lot in the suburbs with their savings, and to erect a house of their own planning by means of a building loan. In their calculations they have allowed for furnishings and for monthly expenditures to the butcher, the baker, the grocer; for milk, ice, water, taxes and interest; for a commutation railroad ticket to the city; and a certain amount that is to be put away to be paid later in installments, quarterly or yearly, to reduce the loan.

Then children come. Perhaps a child was planned for; but scarlet fever, measles, whooping cough and other diseases were not counted in the reckoning. Sometimes if the expense of the illness is paid for, then the interest of the loan or the amount to be applied on its reduction cannot be paid, and thus ultimately through illness the house is lost. Sometimes when the house is finished the head of the household, the wage earner, becomes ill. What then? Perhaps death overtakes him, and his labor for his family and for their future is lost. Perhaps you who read this are planning just such a house. Have you figured on sickness? How much have you laid aside for the doctor or the hospital?

But the loss of educated children is little compared to the loss of those educated in business, and who hold high positions in the business world. Consider, for instance, the president of a savings bank. He must be a judge of the character of employees, men and women who can be trusted to handle money, who must be correct in figures, and polite to depositors. He must be able to judge of investments, and to look into the future, for values may shrink. Who would have thought a few years ago that railroad stocks and bonds would so shrink in value? He must understand the value of property and real estate, for fully one-half of the savings in such banks are invested in bond and mortgage; and investments of this kind depend much upon the character of those wanting the money. It takes a long experience to judge character. He is also custodian of the bank property, and must preside at the meetings of the Board of Directors, and help to fill vacancies upon that board. Such things as I have mentioned require long experience and sound

judgment, and this comes only with time. Our judgments vary largely with age; and the business acumen and judgment of a man of fifty or sixty is different and generally wiser than that of a man of forty or younger. There is no good reason why a man's best work should not be done when past sixty.

So also with the Chairman of a Board of Directors, or the President or Manager of a large industry. His experience and education make him constantly more valuable to himself, to business, to the worker under his direction and to the State. His premature death is often a most serious loss.

The losses thus far mentioned are all calculated upon a money basis. In order that any state or nation may succeed, its citizens must be upright, with high ideals, and have within themselves the restraining influence of a moral education; for what abiding happiness can there be in a state where the standard of morality is low? So it is of even more importance to both family life and to the nation that the young shall early receive proper guidance and training. In this respect the loss of a mother by premature death is worse than all else. Think of what that child misses who has never been taught to pray at the mother's knee, who has never known the smile of mother-love, her tender watchful care, her gentle chiding and her restraining influence! These things can not be reckoned in dollars and cents—they are incalculable.

We must all die; but the date of our death is largely of our own making. Premature death comes from sickness or accident; and most people die prematurely. Only four per cent. of the people die from old age, and even some of these quite probably might have lived some years longer.

I make therefore no apology for offering this book to the public. While the writings of physicians are generally intended for each other, the knowledge they acquire is for use in aiding others. In recent years the aim of many physicians, and others interested in human advancement and in human happiness, has been to prevent illness. Much has been done and is being done to this end. The physician of the future will be as much concerned with prevention as with the cure of disease.

Many people do not know how illness can be prevented. They rely on Boards of Health to prevent epidemics. Much complaint was heard in the recent influenza epidemic that those in charge of health bureaus of cities and states did not do their duty to prevent the spread of influenza. As a matter of fact prevention rests mainly with the people themselves. They lack knowledge of how disease is spread, and are ignorant of the things they should do to build up their resistance to disease, and to prevent the entrance of disease germs to the body. In that epidemic, as in the one of infantile paralysis a few years before, the ignorance and the superstition displayed by the people generally were astounding.

In the army, influenza spread rapidly because of personal contact, fatigue from drill, a depressed or excited mental condition, and especially from lack of certain foods essential to growth and resistance to disease—milk, butterfat and green leaves and fruit. Also because many did not take proper care of themselves, even when conveniences were at hand. Some did not drink sufficient water. Some neglected to have proper movements of the bowels. Others used their toothbrushes to clean their shoes instead of their

teeth, not realizing or not knowing that a neglected mouth is a potent contributing cause of sore throat and influenza.

In civil life also the rapid spread of influenza was, in a large measure, due to lack of proper precautions. Many gave up certain foods that would have helped to sustain resistance, partly because of the increased price of dairy products and partly because they were asked to give them up in order that the army and the nations abroad might have them. In some cases workers suffered from fatigue due to overwork because of high wages, piece-work, or double pay for overtime. These things, seemingly of advantage, are not entirely blessings.

One of our difficulties is that we are constantly searching for some new remedy, some drug to cure disease, looking for the "far off unattained and dim," while we already may have the knowledge to prevent or ward off disease. But prevention is often so simple that it is lightly regarded.

It is to be regretted that a practical knowledge of the human body and its workings is not taught in every school in this country. In my opinion anatomy and physiology should be taught in every school. We should commence early with a knowledge of the human machine and how it works. "Know thyself" was said by a Greek philosopher, and it has been repeated for centuries; but comparatively few have a sufficient knowledge of the human body to enable them to give it proper care.

Very few people, if any, live as long as they might; only a very small percentage die of real old age, and there are many who become old before they should. With our present knowledge of preventing disease all

could be made to live longer, and undoubtedly many could live to be as old as Moses and still lead useful lives. It is, however, of but little consequence that we lengthen our lives unless we increase our usefulness to the world. Merely to live on for personal enjoyment or because we fear to die is not worth while. The great end that we wish to gain is to secure the best health and the longest life for all, that all may better serve the world.

Many established habits that are antagonistic to health and long life need reformation. One of our greatest difficulties is that many people travel along the same road and in the old ruts that their fathers for centuries have trod. They never attempt to make better paths by changing their ways.

One day, through the primeval wood,
A calf walked home, as good calves should;
But made a trail all bent askew,
A crooked trail as all calves do.

Since then two hundred years have fled,
And, I infer, the calf is dead.
But still he left behind his trail,
And thereby hangs my moral tale.

The trail was taken up next day
By a lone dog that passed that way;
And then a wise bell-wether sheep
Pursued the trail o'er vale and steep,
And drew the flock behind him, too,
As good bell-wethers always do.

And from that day, o'er hill and glade,
Through those old woods a path was made;
And many men wound in and out,
And dodged, and turned, and bent about
And uttered words of righteous wrath
Because 'twas such a crooked path.

But still they followed—do not laugh—
The first migrations of that calf.

The author then speaks of how the forest path became a lane, the lane a road, where many a poor horse toiled with his load and traveled three miles in one—and for two centuries and a half, they trod the footsteps of that calf.

A moral lesson this might teach,
Were I ordained and called to preach;
For men are prone to go it blind
Along the calf-paths of the mind,
And work away from sun to sun
To do what other men have done.*

Some of the thoughts put before you in this book are for the purpose of breaking the traditional wrong habits found in many households, such, for instance, as closing windows of sleeping apartments to shut out the night air; not drinking water with meals; the wearing of heavier underwear in winter than in summer, changing in the fall from cotton to flannel—and many others.

In recent years the death rates from some diseases have been much reduced, with a marked reduction in the general rate for the earlier years of life. This has been shown to be especially true where systematic and scientific welfare and health work has been carried on in a community. But not all reductions in death rates are due to such work. Better methods of living, greater food supply, and scientific advancement in many lines have materially helped in this reduction. Credit should be given also to the better construction of houses, and to many inventions for human betterment, such as the automobile, which has kept thousands in the open air and in country homes,

*By permission from Home Book of Verse, B. E. Stevenson. Henry Holt & Co.

and by replacing the horse has led to cleaner streets and riddance of flies, for flies are bred principally in horse manure.

Our health depends upon what we can do for ourselves, upon the care given those employed in industry, and upon the making and enforcing of laws by city, state and national governments. Of all of these the most important is what we can do for ourselves, the care we give our body—the human machine.

Did you ever see the motor of an aeroplane? Did you ever watch it work with its perfect adjustment of valves and cylinders? Did you ever observe a great press print and fold a newspaper; or a machine weave silk or linen into beautiful patterns? Each is wonderful. But wonderful as man-made machinery is, yet more wonderful is the human machine—a human being. Often I have been in the big power houses of steel mills, where mighty engines and motors supply the power for turning the molten steel into rails and structural forms for houses, and into other shapes for the manufacture of machines for our daily necessities. How clean everything is! No dust mars the rods which move with such precision. All are oiled, not too much nor yet too little. The pressures are recorded; everything is watched with minutest care, lest it wear out or break and be rendered useless. Every care is taken to prolong the working life of the machinery. If we would give that same care to the human machine, what could we not do? But generally we fail in the care of this human machine of ours, and sickness or wearing out results.

Chapter II

CAUSES OF DISEASE AND BENEFITS OF PHYSICAL EXAMINATION

What is health? When are we in good health? Good health means that every part of the body performs its work with ease, and without our being conscious of its working; when all parts of the body act in harmony. There are many things which act directly, or contribute indirectly to interfere with such working.

To keep well and care properly for each and every part of the body, especially those parts that have important special work to do and that must keep up their work daily, we must know how disease originates and must watch for the beginnings of disease.

What are the causes of a break-down or wearing out of a part? Some diseases have their origin at birth or even before it. There is a difference in the health of children at birth, and this difference depends much upon the health and care of the mother. It is a great satisfaction to know that to a large extent these differences may be overcome by after care, and if they cannot be entirely overcome, at least we can and should have knowledge of our weaknesses and live accordingly.

Some agencies produce disease directly; others predispose to disease. For instance, pneumonia is produced directly by pneumonia germs, but many a person carries the germs of pneumonia in the mouth, and does not get the disease unless he gets cold, or becomes too tired, or in some other way lessens the

resistance of the body. Sometimes one disease lessens resistance to some other particular disease, just as influenza lessens resistance to pneumonia or diabetes to carbuncle or gangrene. So we usually have a double cause for disease, the direct cause and the contributing cause. Very often the direct cause is a germ, but the contributing cause is usually lack of sleep, or lack of sunlight, or lack of fresh air, or cold, fatigue, dust, constipation, or poor or insufficient food.

Some races of people are more apt to be attacked with certain diseases than others. Thus, certain races are especially prone to tuberculosis; some to diabetes; others to pneumonia. Therefore people of different races should inquire and learn what disease they are most subject to, and beware of it.

Many become disabled from direct injury; that is, accidents. For the most part accidents are due to carelessness, to lack of thought, or to a mind preoccupied on account of a quarrel, or trouble, or sickness at home, or from thinking of the pleasures of the evening before. No amount of guarding of machinery can entirely overcome these causes of accident. To avoid accident one must prepare for the day's work, and think while at work. This is easy to do if one is interested in his work. One should wear proper clothing that may not be caught in machinery, and, if necessary, protection for the eyes, or other parts of the body, insist upon standard safety appliances, avoid unnecessary fatigue, and above all keep one's mind upon the work in hand, and be competent to do that work—in other words, be fitted for the job.

We must also know what are called physical or external causes of disease; such as changes of atmosphere, caused by going up to a great height, or working

in a tunnel or caisson in compressed air underground; or sunlight (sunstroke), or electricity; or insanitary housing, or wrong clothing or occupation; or poisons or chemicals.

The human machine can adapt itself to various surroundings, to heat or cold, to dryness or to moisture, to poisons and parasites, but it cannot go beyond certain limits. This limit varies in different individuals, depending upon many things; such as age, sex and race.

Bacteria or germs are responsible for most of the diseases from which human beings suffer. They may attack us through several channels. Like certain chemical poisons, some act specifically upon certain parts of the body or settle in one particular place. Thus diphtheria germs are more apt to attack the throat; pneumonia germs, the lungs; those of typhoid, the bowels.

Germs constantly find their way into the body, but may be destroyed there. We have in the body what are called leucocytes. These are police organisms which catch and kill germs. Bacteria may come to us in water, milk, and other food; in dust, or from garments or other objects which other people have handled. They may come from insects or from body contact. And they may enter the body in many ways, through the nose, or mouth, to be swallowed with saliva or mucus, and so get into the stomach and intestines; or they may be breathed into the lungs, or may enter through wounds of the skin and in other ways. Large parasites, such as worms, may also get into the intestines.

Disease may also come to us from a lack of balance in our internal secretions; sometimes from overwork,

though more often from want of exercise; frequently from too much food. Many persons suffer from some peculiarity that makes them ill when they eat strawberries, fish, shellfish, or some other foods that poison them even if harmless to most people.

There are many causes of disease, and none of us obey all the rules of health. At any time from some slight infraction, or from ignorance, we may unintentionally injure the body, or interfere with some of its functions. Then disease begins.

Some diseases come on by slow and stealthy means. They are so gradual in their onset that they may go on for some time and cause much havoc without the victim's knowledge.

For every one, especially for those who know little or nothing of the human body, and how it works, it is of the most utmost importance to be examined occasionally by a competent physician, or group of physicians practicing various specialties, to learn whether any disease is beginning. The urine should be examined for albumen and sugar, preferably by a chemist; the blood for anæmia; the weight should be taken to detect gain or loss. The material that is passed from the bowels should be examined; and X-rays of teeth and other parts of the body should be taken, and the records kept for future comparison. All this is necessary to find out if any part or organ is giving way.

There is an old saying, "No chain is stronger than its weakest link." It is so with a motor car. It does not make any difference how strong some parts are made, if one part is weak or not properly cared for, rod, clutch, brake, wheel, or bearing. If such part gives way, the car is useless until mended. So with the human body, it is no stronger than its weakest vital

organ. Your muscles may be good, but if any part, such as your stomach, kidneys, or liver become disabled, or if your heart gives out, you are only as strong as the disabled organ.

Each part of the body is dependent upon the working of the other parts. Each part has its own work to do; and if its work is not done, the rest of the body suffers. If we know that a part is weak, we may by care be able to save it for a long time.

For instance, if one has an impaired heart he must avoid putting too much strain upon it. He must not exercise too much, run, or hurry; he must not go rapidly upstairs, or become frightened, or angry; he must not eat too much. If he is too fat, he must reduce his weight so that it will not be necessary for his heart to beat so hard in order to send the blood to the surface and to all parts of the body. If the disease has originated from some infection, as from an abscess at the root of a tooth, or from the tonsils, or from a facial sinus, treatment must be given to cure the particular part. With the cause of the condition removed, and with baths, drugs and rest, a cure or arrest of the disease is likely to follow.

The same thing holds good for tuberculosis, which until recently, was the "captain of the men of death," which yearly accounted for one-seventh of all the deaths in our great cities. Nearly all consumptives, by outdoor sleeping, by change in occupation, and by more and better nourishment, can be made to live long and useful lives if treated in time, before the lungs break down.

Cancer, which is greatly on the increase, is due locally to a chronic tissue irritation. Death from cancer can be prevented by removing the irritation.

After it has commenced it may sometimes be cured by the early removal of the tumor, or treated by radium, provided it is not allowed to gain too much headway.

We must guard our weak organs. This is not always easy. Many persons have diabetes, or are just on the verge of it. This is another disease that seems to be increasing. Many would probably not be in a diabetic condition unless they were accustomed to eat too much, or at least to eat too much sugar and starch. Diabetes can generally be readily arrested if it is discovered early and the patient is put on a proper and restricted diet. The cravings of appetite are hard to control, and it requires much will power and strength of mind to resist them. So patients must be taught not only the right kind of diet, but the control of the appetite.

How are we to know what organs are weak? Only by a full physical examination, such as I have already mentioned. This examination should be repeated at least once a year, thus watching for commencing disease. Such examinations are particularly necessary if one is not in good health, or for any reason cannot do his daily work.

It has been a surprise to physicians who have made many physical examinations of workmen of ordinary intelligence and education, not so much to find the large percentage of physical defects—this was expected—but to find so few of those examined who had the faintest idea of having defects or who were aware of their impaired physical condition.

Chapter III

AIR

An abundant supply of fresh air is one of the essentials of good health. One may live a month or more without food, several days without water, but only a few minutes without air. Life exists almost from breath to breath. Air is thus more important to us than food or water, though all three are necessary for life.

It has been said by many physicians, as the result of their experience, that of all the predisposing causes of sickness, impure air is the most potent. It is their belief that overcrowding in assemblies, in camps or barracks, and living or sleeping in the same room with others without proper ventilation, help greatly to produce and spread epidemic diseases. This does not mean, of course, that bad air is solely responsible, for communicable diseases are spread chiefly by physical contact, which permits the transference of germs from one body to another.

In the cure of disease we have in recent years learned that fresh air is absolutely essential. Especially is this true in the treatment of diseases of the lungs, such as pneumonia. This is particularly true as to tuberculosis, or that form known as consumption of the lungs. These two diseases together lead all others as causes of death, having been responsible in the past and until recently for about two-sevenths of all the deaths in this country.

"I opened the windows and kept them open and they all got well." Such was a remark I heard made by Dr. Alonzo Clark during a lecture at the College of Physicians and Surgeons, when he spoke of an epidemic of typhus fever which occurred in this city many years ago. Others who have had to deal with other epidemic diseases have had a somewhat similar experience. Free circulation of air is one of the greatest aids in both the treatment and the prevention of epidemic diseases. Only during the last twenty years, since a vigorous campaign against tuberculosis has been conducted, has very much been done toward this end.

The study of the use of hospital roofs and balconies for patients, of outdoor sleeping in general, especially in sanatoria, and of outdoor schools, has taught us much. As a result of this outdoor treatment, many cases of consumption have been cured; in other cases the disease has been arrested. The experience of those who conduct open air schools shows that the children, especially those below normal, gain in weight and in red blood, have better resistance to disease, and are brighter mentally.

We have spoken in another chapter of burning food in the body. To burn this food we must have oxygen from the air. Air is composed almost entirely of a mixture of nitrogen and oxygen. When at rest we breathe, that is, we take air into the lungs sixteen to eighteen times a minute. As the blood circulates through the body, it goes from the heart to the lungs, and from the lungs back to the heart to be pumped through the body. The oxygen in the air we breathe comes in contact with the blood in the very small blood vessels in the lungs called capillaries. The blood there

gives up carbonic acid gas, absorbs oxygen instead, and carries it to every part of the body. The principal use of the lungs is to effect this exchange of gases in the blood. After the blood leaves the lungs, in its passage through the body, it goes through other similar vessels. Here it gives up the oxygen to the body fluid called lymph, and to the tissues, and takes up the carbonic acid gas in exchange. The blood now loses its bright color and becomes dark. In the lungs this color is changed again, and after the oxygen is taken up, it becomes bright; and so it goes on all through life, taking the oxygen to the tissues and exchanging it for waste products, carrying them back to the lungs to be breathed out, breathing out vapor of water in addition to carbonic acid gas. In the tissues where the exchange is made, energy and warmth of the body originate. The oxygen goes into combination with the food stuffs. Our constant breathing out of carbonic acid gas is proof that these combinations of food with oxygen are always taking place.

One can thus readily see that if we live or sleep in a room with the doors and windows closed, especially if there are a number of persons in the room, there is gradually less oxygen to breathe and more carbonic acid gas. Consequently we do not get the proper composition of air, as we should if we lived out of doors. But the good of outdoor sleeping cannot be explained entirely on the ground that we have more oxygen and less carbonic acid gas to breathe. For under ordinary circumstances there is more than sufficient oxygen in the atmosphere. One may live and keep well upon a mountain at an altitude where there is much less oxygen. But while carbonic acid gas is a waste product, it is not poisonous; in fact, some of it is necessary

to make us keep on breathing. Slight changes in the proportion of these two gases do not therefore wholly account for the benefits of fresh air. No matter how the effect is obtained, we know positively that fresh air is a great aid in the cure of disease, particularly disease of the lungs; and that it is best to sleep on a porch or balcony. If one cannot have such a place to sleep outdoors, then the windows should be wide open. But sleeping with the windows open is not as beneficial as sleeping on a porch. Why, we cannot as yet fully explain, and that is because we have not studied the subject sufficiently for the reason that air may be obtained free of cost. Food we must work for. Water we must pipe or dig for. But air being free, we have thought little about it. That is the way of life, we value most what costs us most, either in labor or money.

Until recent years it was believed that poisonous waste materials were sent out of the lungs with every breath. It sometimes happens that when people are confined in a crowded room or below the hatches of a ship during a storm, many become ill and some die. It was thought that death under such conditions resulted from poisonous exhalations; but it was probably not due to such poisons, nor to the carbonic acid gas, nor to the want of oxygen. In the light of modern investigation deaths seem to have resulted from a rise of body temperature caused by heat and humidity, made worse by fright and the discomfort caused by lack of movement of the air.

Much water is exhaled from the lungs. We see this vapor in winter. In summer still more water is breathed out, though we do not see it, especially in hot, dry climates. In a warm, crowded room the air soon becomes saturated with water vapor from the lungs

and perspiration from the skin, and when there is little or no motion to the air evaporation does not properly take place from the body. Moreover, radiation increases the heat, so that no one in the room can properly get rid of his own heat, and with excitement or any motion of the body the heat is increased still further.

One of the most important things to know about air is that it must be kept in motion. This fact we have learned only recently. A telephone booth with the door shut is very uncomfortable, but if there is a fan inside we do not find the atmosphere annoying. The good derived from the mountains and seashore is partly due to the breeze, but much depends on the temperature of the air and its humidity.

It is quite natural that persons should believe in poisons in the breath on account of the odor sometimes present, which may be due to certain foods, such as garlic or onions, or to decayed teeth. Such an odor can also come from the nose, or from the bowels, or from a coated tongue. The strong odor in a crowded street car, when the windows are closed in winter, arises partly from clothes and unwashed bodies. It is true that disease germs may be found in such an atmosphere; but these may come from the mouth in the form of a spray in talking, or in sneezing and coughing. In ordinary breathing, disease germs are not found in the breath.

People may remain in good health at great altitudes, but they cannot do so much work, since they tire more easily. At very great altitudes, where the oxygen is much lessened, many symptoms may arise from lack of sufficient oxygen, such as dizziness, a dulling of the senses, desire to sleep, fatigue, sometimes nausea,

though some of these symptoms may be due to the cold atmosphere. Such symptoms are more likely to arise when the change from the low level to the high level has been made rapidly; they depend also on the state of mind induced by the fear of the change of altitude.

Then also, when men work underground in compressed air, as laborers in tunnels under a river or divers under water, they may become ill and have dangerous symptoms. Sometimes death will occur if the change from compressed air to the ordinary pressure of the surface is too rapid, owing to the appearance of bubbles of air in the blood.

Air may be polluted by poisonous gases or dust. Ordinary gas used in cities for gas stoves and for lighting is a mixture of coal and water gas. The more poisonous of these gases is water gas, known as carbon monoxide. This gas, if breathed, combines with the red material in the blood and destroys the blood's oxygen-carrying power. In living rooms illuminating gas may get into the air we breathe because a pipe leaks, because the light burner, the stove or the log has not been entirely turned off, or because there is a leak or break in the connection. In some cases, where a house is heated by a hot air furnace, such as is frequently used in villages or in the country, if the furnace is made too hot, some of the carbon monoxide may pass through the iron and pollute the air. Outside the house these gases may come from chimneys, even though there is no smoke. In large cities with many chimneys, gases may come in through the open windows of the tall buildings, and on damp cold nights descend into the living apartments of dwelling houses.

Gases from a septic tank or improperly ventilated

sewer, which are somewhat similar in composition, may get into the house through a broken or eroded pipe; though there is but little danger from this source in a city. Some of these same gases may be found in old privy vaults; or in country village houses from cesspools, where there are no sewers. Sometimes gases so permeate the soil near a house that they get into a cellar, and in this way pollute the atmosphere of the house. All such gases are injurious, principally because of their effect upon the blood. Marsh gas (CH_4) and carbon monoxide (CO) are especially harmful.

In working places where there are open fires, such as blacksmith shops, or where open fires known as "salamanders" are used for warming buildings, carbon monoxide will pollute the atmosphere and may get into the human body and poison it. This gas is also made by partial combustion in an automobile; and in a closed place like a garage it may cause death.

Fumes from metals or chemicals may be poisonous; those from lead or phosphorus are particularly so. Men working in tunnels where dynamite is used suffer also from the effect of carbon monoxide, as well as from smoke and sometimes from the unexploded particles of nitroglycerin, which produce a very rapid action of the heart and a severe and prolonged headache.

For many years dust has been considered one of the greatest enemies of mankind. Long ago it was pointed out that death records prove that those who work in dust, particularly those who breathe a mixture of stone and steel dust, such as tool grinders, usually die from disease of the lungs. Lately it has been shown that tuberculosis is one-third greater among workers who breathe mineral dust than among those who do not

breathe it. Investigation shows that if those who have worked in cement mills get pneumonia, they have a much higher death rate than those who do not work in such dust.

The noted investigator, Pasteur, made a number of experiments with flasks containing blood or some other liquid material that might spoil. He found that the liquid in straight-necked flasks would spoil, while in those with crooked or bent necks the liquids would keep sweet for a much longer time. This was because dust more easily entered the straight-necked flasks.

Every housewife knows that if, in canning and preserving fruit, she allows the jars to remain uncovered so that the contents are exposed to the air, they soon spoil. Experience teaches her that the greatest care must be observed to prevent the entrance of air or fermentation will follow.

Dust is composed not only of mineral matter, but also of animal and vegetable matter. City dust consists principally of the waste of horses, smoke from chimneys, and has in it expectorated materials, saliva and sputum, waste from dogs, and other like materials. One can thus see that germs of disease may be found in the street and in houses. Such disease germs are less numerous in the country, though everywhere we find the micro-organisms of mold and fermentation. In cities the substitution of the automobile for the horse has greatly reduced the danger of infection by means of dust derived from horse dung.

By far the greater number of occupational diseases have their origin in dust. Lead and phosphorus take their toll of human lives, but dust outstrips all other causes in the number of victims; and even lead and

phosphorus are most dangerous in the form of dust and fumes.

How does dust work injury? Generally speaking, in two ways—as an irritant and as a carrier of infection. Dust is an irritant to the skin, the eyes, the nose, the throat, and the lungs. It has the same effect as any other foreign body. Dust causes coughing, and persistent coughing irritates the lungs. Moreover, the continuous breathing of dust-laden air leads to a deposition of inhaled particles in the lungs, and to their accumulation in the deeper parts. Inflammatory changes in the lungs are thus produced, which furnish a foothold for the bacillus of tuberculosis or of pneumonia.

Most of the dust that is breathed in is caught in the nose or in the air passages leading to the lungs. In these places provision is made for its removal. But the dust that gets through to the deeper parts cannot all be removed, on account of inadequate natural provision for such removal. The lungs store dust away as best they can, and the little lymph glands become black with these stored particles. Men and animals were not created to live in a dusty atmosphere, and in time dust impairs the action of the lungs by clogging the air vesicles. These are the small spaces in the lungs where the oxygen in the air comes in contact with the blood.

The temperature and humidity of the air affect the heat regulation of the body. Whether we live at the arctic circle or at the equator, the temperature of the human body remains the same. Americans, Europeans, Asiatics, Africans, or the people who inhabit the islands of the sea, all have the same body temperature, between 98° F. and 99° F. And this temperature of the

body can vary but little without a disturbance of health. Even ten degrees up or down means death. To keep the temperature at this level, 98.6°, there is in the human body both a constant production of heat and a corresponding loss. This production and loss should balance day and night, working or resting, in heat and cold.

Retention of heat in fever results from an interference with the mechanism which in health operates to equalize the gain and loss. We are so made that if we produce more heat in the body from work or exercise, we lose more heat. Or if we rest, we lose less. Or again, if we are exposed to cold weather, we produce more heat; if the weather is hot, we produce less. The muscles and the internal organs are largely the makers and regulators of heat, whereas the skin and lungs are principally responsible for the loss of heat. There is a great difference in the character of muscles, varying according to exercise, and possibly as to climate. Generally speaking, in hot climates muscles are not as firm as in cool or cold climates. This may, however, be entirely due to lessened exercise in a hot climate. Heat production must vary to some extent with the character of the muscles. The greatest regulator of heat loss is the skin. It is self-regulating. We lose heat through the skin, first by the amount of blood in the skin, which is regulated by certain nerves that control the size of the blood vessels; second, by means of sweat glands, the action of which is also controlled by the nerves. In addition we lose heat in the moisture that we breathe out from the lungs.

When we stand near a stove or a fireplace, we feel the heat radiated from it. Heat is lost from the human body in the same way, by radiation. It is also con-

ducted from us by things we touch or that touch us, by currents of air which are warmed by the body, or by evaporation of water from the sweat glands. In a hot and humid climate, perspiration is noticeable, but in a very dry climate it is seldom seen, even though more water is lost. In the latter case perspiration dries up and goes from the surface of the body in the form of invisible vapor.

When water changes its form it either absorbs heat or loses it. Thus when ice at 32° F. changes to water at 32°, in the changed form the water absorbs heat, which becomes what is known as latent heat. When it boils it again absorbs heat, which disappears in the vapor. It takes a great deal of heat to make water evaporate. So in a breeze, the moisture on the outside of the body evaporates and this cools the body rapidly; the drier the breeze, the more rapid the cooling. In the tablelands of Mexico, if one were to take a bath in a river and stand wet in a breeze, the cooling would be so rapid that the skin would take on the appearance of goose-flesh, no matter how hot the day. The principle of cooling by rapid evaporation is used also in hot, dry climates for making the naturally warm water cool and palatable by putting it into an olla. An olla is a jar of clay which is porous, so that when water is put into it, moisture comes through in the form of a sweat. When hung in the shade with a draft upon it, the water on the outside rapidly evaporates and this cools the water within the jar; canvas water bags are used for the same purpose in South Africa.

The human body can adapt itself to wide variations of temperature, but because of clothing and humidity it cannot always regulate heat loss. Clothing prevents radiation, and humidity prevents evaporation. So

long as perspiration can evaporate freely, heat production and heat loss balance.

In a hot moist climate, much blood is brought to the surface of the body, and then both mental and physical activities are reduced. Cold, damp air causes greater production of heat and overworks the heat-making apparatus. So on a damp day in winter in New York, we feel the cold more than we should in the drier climate of the west or in the mountains, even on much colder days. This is why wet clothing is harmful in cold weather. In a damp climate, then, we find it difficult in the humid days of summer to get rid of body heat; while in winter we use up more food to keep warm.

In a very dry climate, changes in temperatures are very great, between shade and sunshine, and between day and night. Sometimes these changes range to almost 100° F. Such great changes are not conducive to health; a climate that is more uniform is to be preferred.

It has usually been supposed that the drier the climate the more beneficial it is for certain diseases, especially those of the lungs. In very dry and warm climates, like those of many desert countries, a large amount of moisture is lost from the system. In Colorado, for instance, a person breathes out from the lungs at least one-half a pint more water in twenty-four hours than in Florida. Unless this lost moisture is replaced by water, many parts of the body do not work well. Without water, they cannot perform the work for which they were intended.

In a very dry climate, newcomers are apt to lose weight, and to pass less urine. The concentrated urine may cause irritation of the bladder and the kidneys,

and constipation is common and obstinate. The mucous membranes of the nose, mouth, and throat are apt to become dry, especially at night if one sleeps with the mouth open. These membranes sometimes become so dry that they crack and the ducts of the mucous glands become plugged, while sore throat and tonsilitis are common. This may result in trouble with the voice, in more or less deafness, and in chronic inflammation of the nose. The inflammation of the nose may be made worse by dust, for there is apt to be dust in dry regions.

Human beings were intended to live in air. The structure of the body shows that not only is air required for breathing but also that air should envelop the body. Civilization, however, demands that we wear clothes. The fashion and custom are not dictated by doctors nor those who make a special study of the body. As I have already explained, all clothing interferes with the normal body processes of heat regulation. This means interference with the building up and the using up, or as it is called, the breaking-down processes of the body. We should, therefore, as far as possible, give the skin a chance to do its duty. As we may not go unclothed at all times, we should do so at such times as we can. That is, we should frequently give the body an air bath. An air bath means exposure of the unclothed body to the air. And this should be done often, daily, or twice a day if possible. If we cannot have an air bath during the day, we could perhaps take one night and morning. At such times as we dress and undress, and while we brush the teeth and attend to other duties of the toilet, we can take the desired air bath. This is but little, however, compared with what we should have. Cold showers, exercise,

sun baths and air bathing, all have the same general effect upon the skin, namely, to increase its capacity for blood and to redden it by bringing the blood to the surface. This produces a better circulation and a healthier skin, rendering a person less sensitive to cold and drafts. The skin of some persons is so sensitive, on account of clothing, that the shock of cold water is very great. With such a one, an air bath may be used as a substitute, merely using a wash cloth for purposes of cleanliness. The Greeks and Romans of two thousand years ago practiced air bathing. And now in our day, certain European countries have open air gymnasiums and sanatoria for the same purpose. At such places, air baths are combined with exercise. Here one may have bowling, tennis, golf, or setting-up exercises. In this country it is the practice of many to combine air, water and sunshine, on the beach at the seashore. But we need such places in winter as well as in summer. When the air is dry and still, one may go out unclothed in winter, even though snow is on the ground, provided he or she has commenced to expose the body when the weather is warmer. In taking such a bath, it is best to remove all clothing except a loin cloth. We need more of these open air gymnasiums in this country, and it seems to me that possibly we might devise some way to use our roofs for this purpose.

Rooms should be properly ventilated. This would help insure against poison by gases. No artificial method of ventilation can equal open windows. In very cold weather, however, this is a difficult matter. People are still afraid of drafts, though many a person who is afraid of a draft is willing to sit in an open motor car and be driven through the air at a rate that creates a draft much greater than any ever experienced

in a room, and yet has no mental disturbance. It is a pity that we cannot have more open fireplaces, for they help much to ventilate a room and not to overheat it. Moreover, they keep the air in motion. In "The Courtin'" James Russell Lowell says:

"A fireplace filled the room's one side,
With half a cord of wood in—
There warn't no stoves (till comfort died)
To bake ye to a puddin'."

If we cannot get all the ventilation we want during the day, we can at least at night. So keep your windows open when you sleep.

Because of their occupations many persons spend their lives sitting still. So some never have sufficient exercise to breathe deeply, and they acquire the habit of taking shallow breaths. Such persons should form the habit of occasionally taking long and deep breaths, to exercise the muscles connected with breathing, and thereby bring the whole lung into use. In the Far East such exercises are often practiced as a part of the religious rites. The people there practice holding one nostril closed and breathing through the other, and then changing to the opposite side; taking a full breath through one nostril and letting it out through the other; and holding the breath a short time after the lungs are filled. This is done several times daily. It is claimed that such exercises have a calming and soothing effect.

Chapter IV

DRINKING WATER

Could anything seem more simple than to drink a glass of water? Yet it is one of the most important things we do daily.

Our bodies are made up largely of water. Over two-thirds is pure water. Different parts of the body differ in the amount they contain; thus, the blood is about 90 parts water, muscle about 75 parts, the saliva over 99 parts, and the gastric juice not very much less. Even the teeth contain water. Water enters into, and is an important part of every tissue, of every organ in the body.

We can judge of its importance only when we do not have it. Persons can live but a few days without water; but on the other hand, if they have water, they can go thirty days without food. Why can we live so short a time without water? Because we constantly lose it. We lose it from the lungs by breathing, from the skin by perspiration, from the kidneys, and with movements of the bowels. In the winter time we can see the water in the breath. What we lose by the skin depends somewhat on the temperature and dryness of the weather or room, on clothing, and a great deal upon exercise. On an average we lose from the whole body about five pints daily. If we do not take any drink, and constantly lose water, the blood and the secretions get thicker, and the various organs stop work.

It is said by physiologists, those who study how the body works, that we may suffer the loss of all our fat, and a great deal, perhaps half, of our flesh; but that we may lose only one-tenth of the water contained in the body. Loss of water beyond that amount, if not made up by drink, will kill us.

We know from experience that those who take too little water have lessened efficiency. In such cases one is apt to have a headache, to become nervous, and to have disturbances of digestion. Yet simple and necessary as it is to drink water, it is sometimes very difficult for doctors to get their patients to drink a sufficient quantity. I have frequently found it necessary to prescribe some expensive mineral water, or to put a lithia tablet or something else in the water, in order to induce a person to take a sufficient quantity; though the real benefit is from the water and not from the lithia.

The older army doctors always tried to teach the soldier to drink very little water, often to go without it in order to get used to doing without it. Nothing could be more foolish. Think of a man who would not put any water in the radiator, or oil in the bearings of his motor car, in order to accustom the machine to do without, and thus make it as "hard as nails." Such an argument is nonsense.

But objections to drinking water have arisen with some people for a different reason—a fear of water. At the encampment at Gettysburg, on the fiftieth anniversary of the battle, where I served as an officer in the medical reserve corps, many of the old soldiers suffered unnecessarily from heat, and various bodily ailments because of not drinking sufficient water. Yet wholesome water was at hand, as the ground had been

piped, and there were sanitary drinking fountains at frequent intervals. So deeply rooted was their prejudice against water, and so difficult was it to convince most of these veterans that water was good for them, one might almost have called it the second battle of Gettysburg. This acquired fear had come from their drinking water from polluted rivers and other sources which caused typhoid and various water-borne diseases while they were in the army. They did not know that it was not the water, but the bacteria in it that caused these diseases. And many of these veterans taught their belief to their children and grandchildren; a circumstance which shows how an acquired and inherited false belief may continue.

The first great thing to remember about water is that it increases all the secretions, though not all in the same manner.

Secondly, water is nature's great solvent. Therefore it is necessary to take water with food in order that the food may be in solution, as it can be absorbed only in that form. As a solution it goes into the lymph and blood vessels and is carried to all parts of the body. There is still a third function. Water increases the wave-like motions of the stomach and intestines and sends the food along faster. Especially is this true if we drink water that contains carbonic acid gas.

Let us examine more in detail the effect of water on the secretions, by means of which our food is digested. The first secretion to act on food is that found in the mouth, called saliva. This comes from three pairs of glands. Saliva is for two purposes—one to keep moist the mouth and food by mingling with food and softening it, so that it can easily be swallowed; the other to

act upon the food itself, aiding in its digestion. It has been found that saliva is more efficient and does better work when it is somewhat diluted. We have here an argument in favor of water drinking, provided the food has not been bolted but has been properly chewed to mix the saliva with it. Many have heard, when young, that a person should not drink water with meals, or at most only a little, for fear of diluting the gastric juice. But that idea is not correct. Scientific investigations show that drinking water with a meal is of great benefit, that water merely by its presence in the stomach, increases the gastric juice in quantity and in strength. In general the more water we drink the more gastric juice is secreted. We must, of course, consider the capacity of the stomach. Milk, which is considered a perfect food for the very young, is about 87 parts water, which indicates to some extent the proportion of solid food to liquids. But water not only helps to improve the saliva and to increase the gastric juice, but all the organs that make secretions.

It has been shown that copious drinking of water stimulates the pancreas to work and increases its secretion. This organ, the pancreas, is behind the stomach, and between the main portion of the liver and the spleen. It is somewhat like the glands that secrete the saliva, only much larger. It manufactures a juice which it pours into the intestine in common with the bile from the liver. This juice or secretion continues the digestion of meat products after they have been acted upon and have left the stomach. Particularly it prepares starches and fats for absorption and use in the body. So in still another way water aids digestion.

Especially does water act on the kidneys, increasing not only the quantity of urine, but the amount of solids

in it. And as the kidneys help to get rid of the waste products of the body, water, in this way, aids excretion.

Water helps to increase the secretions of mucous membranes. When one takes too little water, especially in a hot dry climate, these membranes if exposed to the air get dry. In this manner a lack of drink tends to make the throat sore. Absorption of water into the system increases the fullness of the blood vessels, and this aids secretion, and the elimination of waste.

Besides mucous membranes, there are many other membranes that must be kept moist. Many must be moist to prevent friction. The lungs when we breathe; the lining of the joints when we move our limbs; the coverings of tendons; and also the covering of the intestines. The brain and the spinal cord are surrounded by fluid. After food is absorbed and goes to various portions of the body it is either used, or stored up for future use, or else becomes a part of the body. In each of these operations many chemical changes take place, and all of these changes and transformations of food are facilitated by the presence of water. Finally, when the food is all used, the carbonic acid gas coming out of the lungs, and the water from the lungs, skin and kidneys, are the end-products of waste. But between the food as taken in and these final products of waste, there are many chemical changes. And to have the carbonic acid gas come out of the lungs and the oxygen absorbed, the lungs must be moist.

As has been already stated in the chapter on fatigue, whether we wake or whether we sleep, there is always within the body a building-up process, a making of new parts and a replacing of old. There is at the same time a wearing out or wasting of the body,

for constantly food must be burned for heat to keep us warm, and for energy to enable us to move. Even in sleep the heart and lungs are moving, and as the food is burned, waste products are produced, just as burning coal produces ashes. Scientists have proved that these waste products are a cause of tiredness. The greater the amount and the more concentrated the waste, the more we are fatigued. The waste is removed principally by being taken up in the blood stream and carried to the lungs, where the carbonic acid gas goes out; the solid particles, dissolved in water, go out through the kidneys. Drinking water helps to get rid of these waste products, for the blood will hold only just so much water, and if more is taken than is needed the kidneys and other channels of elimination work faster. More water is sent out of the body and with it more waste. So one way to maintain one's efficiency and avoid getting tired is to drink sufficient water.

We have said much of how food makes heat to keep our bodies warm. It is just as important for us to get rid of any excess heat that is made. In health the body temperature is the same the world over. In winter and in summer, in the Arctic Circle or in the tropics, in all seasons, and all climates, it should be about 98.6° F., and we cannot deviate much above or below this figure. In fever one's temperature may go as high as 107° F., but seldom higher without death; and still fewer degrees can it go below 98.6° F. Any rise of temperature above normal disturbs the proper working of the various organs in the body. Some of the heat we manufacture is produced in various structures of the body, but most of it is made in the muscles. In active exercise or unusual labor heat is formed

rapidly, and if not lost by perspiration and by moisture that comes from the lungs, it accumulates and the body temperature rises above normal, as it does in fever. This happens not infrequently in the humid days of summer, because radiation and evaporation of moisture from the body, carrying away heat, is largely prevented by the high percentage of humidity in the air.

The natural escape of heat from the body is much diminished if we shut the heat in our bodies by heavy and tight clothing. Once I took the temperature of a man whose work lasted for ten minutes every two hours in a very hot place. He had just finished the resting period and his temperature was 98° F., a little below normal. In order that he should not be burned he wrapped his limbs and his body around and around with much clothing and sacking, then jumped into a hogshead of water until all his clothes were thoroughly wet, then worked hard for ten minutes. At the end of that time, I took his temperature again and it was nearly 102½° F. In ten minutes his temperature had gone up over four degrees. This was because much of the heat he manufactured within his body could not escape, and he lost but little except that which could go out from the lungs. For the same reason those who work in stills, removing the solid material after the distillation of gasoline and other products from crude oil, sometimes suffer in a like manner. To prevent this their periods of work are limited to five minutes.

A dog, because he has no sweat glands, has to get rid of his excess heat after running principally by means of the lungs, hence he pants rapidly after exercise.

In 1756 the ruler of Bengal with a large army besieged Calcutta, which was evacuated by the English.

The withdrawal was so rapid that a number of the garrison were left behind, and of these 146 were thrust in a prison room 18 feet square, with two small windows. The following day only 23 men remained alive. This prison room has since been called the Black Hole of Calcutta. What caused the deaths? I was taught that it was bad air, made bad by the poisons in the breath of the people confined there. In the light of our scientific knowledge of to-day, we have reason to believe that this was not the case. Even though there may have been a considerable excess of carbonic acid in the air, and though the oxygen in the air may have been somewhat reduced, the deaths were probably not due so much to these causes as to the heat and humidity of the air and to the fact that touching one another in air without movement, they could not get rid of the heat manufactured by their own bodies. So those who succumbed died from increased body temperatures; that is, from fever, or what we know to-day as heat-stroke or heat-exhaustion.

Everyone knows that even a few minutes in a telephone booth with the door shut on a hot, humid day, seems unbearable; yet if there is an electric fan in the booth, we do not experience the discomfort. A study of crowded workshops and schools tends to show that some of the lowered vitality of workers and school children is due to increased body temperature, caused mostly by moisture in the atmosphere, which is steadily increased by the moisture from the breath and skin of each worker or child. Much of our loss of heat takes place through the lungs and the skin. Drinking plenty of water aids the action of these organs and helps to keep our temperature normal.

Water not only regulates the temperature of the

body, but acts also as a distributor of heat. It carries heat from one portion of the body to another, and thus helps to maintain an even temperature throughout.

We know from experiments that drinking water reduces the number of bacteria in movements of the bowels; provided, of course, that the water we drink is wholesome, that is, free from disease-producing bacteria. Drinking cold water stimulates the heart. To some extent, also, it relieves fever.

To drink water to aid in the cure of disease is not new. Warm drinks are given for "colds" the world over, in the form of flaxseed tea or chamomile tea, or the brew of some other herb supposed to give virtue to the water. Only recently I read a very interesting book on the "Virtue of Water," published as long ago as 1726, in which water was extolled as a cure of disease.

There are several things in connection with drinking water that we should know. Remember when drinking with meals, that the capacity of the stomach is limited. A quantity of ice cold water may produce cramps. On the other hand, water that is lukewarm is unpalatable, and ordinarily a person will not drink a sufficient quantity of it. Water, then, should be cool, especially in summer. The temperature should be about 50° F. We must remember, too, that drinking water relieves thirst; and that it is far better, as a rule, to relieve thirst with plain water than with many of the drinks made up for that purpose.

We must remember, also, that impure water may carry disease. Therefore it must not flow through lead pipes; for some lead may be taken up in the water, and lead is poisonous. The germs of dysentery, diarrhœa and typhoid fever may be carried in water,

and sometimes if in sufficient number bacteria in water may cause indigestion. Asiatic cholera is a disease carried almost exclusively in water. Worms and other animal parasites may pass into the body with drinking water. But boiling water, or properly filtering it, or putting chlorine into it in proper quantity makes it safe.

Besides the diseases carried by water itself, other diseases may be acquired from drinking cups used in common. Many germs are found in the mouth, and almost any of these bacteria may be left on the lip of the glass or cup. For this reason, workers, unless provided with sanitary fountains or paper cups, should have their own glasses to drink from.

Chapter V

FOOD

So many books have been written about food that we could not read them all. If we did read them, we should find much that is unnecessary except, possibly, to physicians, and many differences of opinion; for doctors differ. Physicians are much like ministers of the gospel, who sometimes argue about things that are not essential, and thus make different sects in religion. In both religion and medicine there are foundations upon which all can agree. What are these fundamental facts as regards food? Just how much need we know? As all about food cannot be written in a single chapter, we will pick out some of the more important things that every person should know: why we eat; what food means to us; what one can do for himself to aid digestion, by the proper selection, including variety and cooking of food; by regulating the number of meals in a day; by choosing the place in which to eat; and by causing the mind to help digestion.

No one can live or work without food. It is from food that our body is built. After we have eaten food it is digested, that is, becomes softened and dissolved, so that it may be absorbed. After absorption it is either burnt up, yielding heat and energy, or it becomes part of the body; it becomes living material, and in this way we obtain our growth.

By means of food the worn out tissues of the body are replaced; and this is one way in which the human

machine differs from other machines, in that it repairs or mends itself. From food comes all the energy of the body. Thus the amount of work that can be accomplished depends much upon the kind of food eaten. From food we derive the heat of the body. So food is used for growth, for maintenance, for work and for warmth. And finally, resistance to infectious diseases depends very much upon the wise selection of food, the quantity and its proper digestion. To choose wisely means that we should select food for all the needs of the body.

The body is made up of various kinds of tissue; of bone, flesh, sinews and fats; also of minerals such as lime, common salt and iron; while starch and sugar are found in the liver and muscles. Milk is the only single food that can build or rebuild all of the tissues of the body. It does well for babies and little children, but as we grow up, the quantity needed is so great that it becomes too bulky and other foods become necessary. No other single food can make, replace, and repair all of the adult tissues, so we must select for each meal food for these purposes; as these are not to be found in any one food, a mixed diet becomes necessary. The wise selection of food then means the choice of such combinations of food as will meet the needs of all parts of the body. Scientific people call this a balanced meal or balanced ration.

What, then, are the kinds of foods that we need? First, we require those that build up muscle and certain other tissue. These are food, like meat, fish and eggs. Second, we need those that supply ready fuel, either for heat or for work, for the body must be kept at a certain temperature day and night. These foods are starches and sugars, and include bread, potatoes

and all grain foods such as corn, wheat, oats and sweets of any kind, including pie, cake, sirups or preserves. We need also a third kind which is a different kind of fuel; one which is used more as a reserve and which acts as a protection for the body. This is fat. Fourth, we need certain foods which contain the various salts already mentioned, such as phosphate of lime to make bone. We must have foods that supply the mineral part of the body. Fifth, we must also have food that supplies certain vital elements which in recent years have been found necessary to maintain weight, and produce growth and which are necessary for life. These are called protective foods or vitamines. They occur in milk, butter, and green leaves, tomatoes and certain fruits with their fruit acids. Lastly, we must consider foods that furnish liquid, and those that have sufficient bulk to keep us from feeling hunger and to make waste.

At every meal, or at least every day, we should have some of each of these different kinds of food. The amount of each kind, however, should vary somewhat according to the work in which a person is engaged, whether physical labor or mental work.

To reckon the quantity that should be eaten daily or at a meal, most books written upon food tell people about calories. By that they mean the amount of energy or heat that one can get from any particular kind of food, reckoning that a person should have so many calories a day. This method of reckoning is misleading to those who have no medical knowledge, because the requisite amount of calories could be obtained from a single kind of food, such as grain, or fat, or sugar. But this would not fulfill our requirements; we must have variety. Some protective foods may con-

tain but very few calories, yet they are just as necessary as any other. Such, for instance, is lettuce and tomato salad. Some foods that yield a great many calories are not very digestible and cannot be eaten by everyone. Calories may be left to physicians to reckon for their patients or to teach where necessary; but under ordinary circumstances the amount of food taken may be regulated by the appetite, hours of labor and character of work, sex, size of the body, temperature, weather and other circumstances.

We have said that eating one kind of food will not maintain the body in health. What would be the effect of living upon a single kind of food? As far back as the Civil War it was learned that those who ate only one or two kinds of food became ill. Many soldiers, because they did not have sufficient variety of food, and were limited to a few kinds, suffered from scurvy, a disease in which the patient becomes very weak. It shows principally in spongy gums that bleed, also in spots that occur upon the skin from the breaking of little blood vessels underneath. Scurvy occurs in this country most often in babies who are not properly fed; and was formerly quite common among sailors, though now it attacks them but occasionally. It is cured by adding to the food such articles as orange or lime juice, tomatoes, cabbage, onions and other foods containing vitamines. Nor is scurvy the only disease that comes from an unvaried diet. A disease which we have frequently heard of in recent years is pellagra, from which many persons in the south suffer. It is characterized by disease of the digestive tract, the skin and nervous system. Undoubtedly in this disease a faulty diet is the underlying or predisposing cause. Some of the dwellers in the Far East, who live exclusively on

polished rice, have a disease which affects principally the nervous system and produces dropsy and a wasting of the muscles. It can be cured by eating the whole rice instead of the polished rice. Rickets, a disease of children in which there is a faulty growth of bone, comes also from a deficiency of certain kinds of food, and has been cured by the administration of cod liver oil.

In certain experiments made upon rats, which consisted in keeping them on a restricted diet free from butter fat and green leaves, a disease of the eyes developed and blindness occurred. This disease has also been observed in some children in certain foreign countries, and results also from absence of similar articles of diet. Experiments upon animals—chickens, calves and rats—feeding them upon a single kind of grain, a single food, or a combination of two or three foods which do not supply all the needs of the body, have shown that these animals suffer from diseases similar to those I have described. Even if they do not become ill, these animals do not breed well; that is, they have very few young, if any. Such young as may be born to them are stunted in growth, and their life is much shortened. These experiments show the great importance of a proper regulation of the diet. They show that bodily activity, growth, and length of life depend largely upon the character of the food.

Our knowledge that growth is influenced by certain foods has been amply confirmed by the condition of the children in Vienna at the end of the war and since that time. The people there have lacked not only a sufficient quantity, but also certain kinds of foods, particularly those containing the vitamines. Many children of seven are but a little more than half the normal size,

and children of fourteen resemble those of ten. In hundreds the bones are softened and distorted, not only by undernourishment in general, but particularly by a lack of milk, and similar life-giving foods.

As regards extent of life, we have come to regard seventy years as the length of man's life; having heard this figure frequently read to us in the burial service, or quoted from the ninetieth Psalm, which reads as follows: "The days of our years are three score years and ten; and if by reason of strength they be four score years, yet is their strength labour and sorrow, for it is soon cut off and we fly away." It is written as a prayer of Moses. Seventy years may have been the span of life in David's day—possibly so in Moses' time, yet Moses himself lived to be one hundred and twenty years old.

Possibly David rewrote or altered this particular verse. David had his periods of exaltation, at times sublime in thought and work—but at other times, after indulgence of his passions, he descended into despair—and from the pessimistic tone of the latter part of the verse it would seem the writer either had indigestion or was suffering from remorse. It is much more probable that the correct length of life is recorded by Moses in Genesis, chapter six, third verse: "My spirit shall not always strive with man for that he also is flesh; yet his days shall be an hundred and twenty years."

When we have learned more about food and how the body works, we shall undoubtedly find that more persons will live beyond the century mark than at the present time; for within fifty years the average length of life has been very much increased. This has been due principally to the discovery that microbes are the cause of many diseases, and to consequent advances

in surgery, to the discovery also that insects carry infection, to adequate wages, to more and better food, to improved water supply, to cleaner streets, and to more sanitary houses.

One is much impressed with recent experiments on animals, especially rats, in which the manner of feeding is shown to determine how long they shall live. Let us be more specific. If a pair of rats is given meat, grain and tubers such as potatoes or beets, the animals will live ordinarily from ten to fourteen months, or about one year. But if to their diet are added milk and cabbage, the rats will live nearly three years. This fact has been known only a short time. When we shall have learned more about food values, and the knowledge we have derived from these discoveries shall have been applied to the everyday living of human beings, who can say how long a person will live, or what shall be called old age in the future? If animals' lives, because of a faulty diet, terminate at one-third to one-half the span they might have reached, it is reasonable to believe that many people could be made to live much longer on a wisely and scientifically selected diet. The number of years we may live depends, therefore, primarily and principally upon the kind of food, and the quantity, we eat. In this connection it is an interesting fact, and a subject about which we have much to learn, that the growth of plants and their vitamine content depend much upon whether the soil in which they are grown contains lime, and that even the quality of any lime that may be present in the soil affects the plant. The plants eaten by cattle control in turn the vitamine or protective quality of the milk produced.

What a wonderful subject for future investigation!

What an immense field of interesting and valuable research is opened! How much there is awaiting discovery! Our greatest discoveries are before us.

The first and principal rule of eating, in order that we may be well and strong and have plenty of energy, consists, therefore, in the selection of a diet that includes all the classes of food mentioned. In order to supply all the needs of the body, the diet should always include butter or milk or green leaves, since they contain the vitamines. We do not know the chemical composition of these so-called vitamines, though we have learned much of their value, but we do know they are essential to life and health.

It has been found that the fat contained in artificial butter, or butter substitutes, has not the same effect as butter itself, and will not keep a person in the best of health. It is important to know this in view of the large number of substitutes. Even butter itself if kept for several months loses its greatest beneficial effect. It is thus readily seen that the diets given in the older textbooks are not satisfactory standards. Not only may a faulty diet be the direct cause of disease, but it is associated with or is the predisposing cause of many diseases, and always delays recovery from disease.

Thus disturbance of the heart's action is frequently a question of diet. How often a patient comes to a doctor complaining of heart trouble when it is simply indigestion! In cases of high blood pressure and trouble with arteries, diet has much to do with the cure—for some food substances are apt to increase blood pressure. Asthma is often a symptom of stomach or intestinal trouble due to a wrong diet, or even more often to some peculiarity of constitution

as regards certain foods; an insufficient diet is one of the main contributing causes of tuberculosis and everyone knows that besides outdoor sleeping and fresh air, diet plays a most important part in the cure of that disease, though enforced feeding in tuberculosis has sometimes hindered recovery, especially in cases in which too much meat and eggs have been given. The cure of diabetes consists almost entirely in the regulation of the diet—lessening starches and sugars and in general the quantity of food, and increasing particularly green leaves. Similarly, in Bright's disease meats and salt must be cut down.

The relation of diet to disease of the skin is most intimate. And it is almost needless to add that in ailments of the digestive organs regulation of the diet is usually the principal treatment. In typhoid fever, milk sugar is of the greatest importance. Neuritis is inflammation of a nerve or nerves, which is generally marked by neuralgia; sometimes by loss of sensation. There are many cases of neuritis and of joint disease which are caused by a focus of infection, such as a diseased tonsil or a decayed tooth, where the symptoms continue even after the cause has been removed. In some cases the pain and other symptoms are kept up either by the unsuitable character of the food taken or by overfeeding. In joint diseases much stress has always been laid on food, and red meats especially have been held up as things to avoid. From recent observations it would seem probable that the quantity of food eaten has as much to do with recovery as the variety and quality.

For many years uric acid has been held to be the cause of a long list of diseases. At the present day we know that it is a cause of gout, and gouty complica-

tions of some other conditions, but that it is not the cause of many of the diseases formerly attributed to it, nor is it the only cause of gout. It is natural for the blood to contain the waste products urea and uric acid. It carries these products to the kidneys to be excreted. Uric acid becomes a possible cause of disease when it accumulates in the blood either because there is a decreased alkalinity of the blood, or more likely a loss of ability by the kidneys to eliminate uric acid when present in the blood in relatively large quantities. Other factors, such as focal infections, poisoning from indigestion, alcohol, worry, overeating without active exercise, and possibly an inherited predisposition may combine to lead to the deposits, in the form of hard lumps, found in the tissues around the joints and elsewhere.

It is probable that in the future, when people have learned better how and what to eat, such a disease as tuberculosis, and possibly other diseases, will largely disappear. There is no question but that when the diet is faulty people are more apt to become a prey to infectious disease. Not only does food affect the general health, but it affects the mental capacity. Children who are underfed are often backward. On the same principle some of the differences between nations and races are due partly to differences in diet.

We must not only consider the kinds of food, but realize that to be of use to us the food we eat must undergo digestion; that is, be softened and dissolved and made ready for absorption. The best of food will fail to afford nourishment if it is not digested. The digestion of food depends on many things besides selection, as, for instance, chewing. In chewing food we cut and grind it to pulp with our teeth that it may be

more easily digested. It is further softened by the saliva, and the saliva itself aids a little in digestion. In chewing we obtain more flavor, and this is pleasing to us. The fact that it is pleasing, in itself helps to secrete gastric juice that digests the food.

If we chew the food a great deal and eat too slowly we lose some of the flavor, and we lose our appetite to a certain extent, and may not eat enough. With too little, hasty and rapid chewing we are apt, on the other hand, to eat too much. There is always a middle course which is right. If children swallow chunks of food they may have convulsions, and grown persons who have this habit may get indigestion.

Much of our knowledge of how food is digested has been obtained from two men. We will return to one of these in connection with the care of the teeth; namely, Dr. Beaumont, and his experiments with his patient, St. Martin. Dr. Beaumont found that when he made St. Martin angry, the secretion of the gastric juice was checked and digestion was interfered with. Prof. Pavlov made a great many experiments upon animals which tended to show that the rate of secretion of gastric juice is determined by the kind of food. He found that meat requires the most gastric juice to digest it, and milk the least, and that not only the quantity, but the quality, of the gastric juice varies with the kind of food taken.

Pavlov's experiments prove that the secretion of gastric juice is controlled through the nerves that connect the brain and the mouth with the stomach, and that if these nerves are cut the flow of gastric juice ceases. He found that the mere introduction of food into the stomach does not make the gastric juice flow immediately, but that the effect upon the brain of the

sight, taste and flavor of food causes it to flow abundantly. So food, to digest well, must be appetizing in appearance and eaten in favorable surroundings.

Pavlov concluded that "Appetite spells gastric juice"; in other words, that the taste, the flavor, and the enjoyment of food and the consequent effect upon the mind has much to do with the secretion of the stomach. As Shakespeare says, "Good digestion waits on appetite and health on both." Unless a person enjoys his meal, it is not well digested. Accepting the conclusions reached by Beaumont and Pavlov, we may say that if there is any mental disturbance, such as anger, worry, a "grouch," or if the food is unappetizing in appearance, or not of proper kind, there is a lack of secretion of gastric juice. As a consequence, the food is not properly digested, and as a further consequence the body is not sufficiently nourished, is easily fatigued, and is therefore inefficient. Solomon spoke wisely when he said, "Better is a dinner of herbs where love is than a stalled ox and hatred therewith."

So a great thing to remember about food is that to have it well digested it must be properly prepared; that is, rightly cooked, tasty and attractive to the eye. Food should be moderately chewed, eaten with good cheer and in cheerful surroundings, and never when one is very tired or angry. So also one's likes and dislikes must be considered. Even a diet containing all the necessary food factors may still prove unsatisfactory because of physical objections on the part of the person who eats it.

It is important to distinguish between hunger and appetite. Hunger comes from the sensation produced by contractions of the muscular wall of an empty stomach. These contractions give rise to a feeling of pres-

sure and bodily weakness and a strong craving for food that can be satisfied with any food. Some people are never hungry, and one reason is that their stomachs are never empty. Some are always hungry; but that does not mean that they require continuous feeding. It is a curious fact that if one fasts—that is, goes without any food and takes only water—after a few days hunger is apt to pass away. Appetite comes with the need of food, and is affected by the condition of the mind. It has to do with the relish and the quantity of food. Gastric juice flows from appetite.

Some people never secrete enough gastric juice. In such cases meat extracts will increase the flow. If, therefore, we judge we need food and yet lack appetite, we may commence a meal with a meat soup. A traditional wrong belief in this regard is that taking bitter tonics or bitter medicine in the stomach will increase the gastric juice, and so aid digestion. Bitters, however, are of no value in this regard. They do not thus increase the flow of the gastric juice, nor do they increase appetite. It is possible, however, that they have some effect by affecting taste.

Some people have too much gastric juice. Pavlov has shown that fats tend to check this secretion—so the use of fats may be beneficial in cases in which secretion is too great.

Physicians often find wrong beliefs in regard to food. For instance, nearly all persons have the idea that raw eggs are more easily digested than cooked ones, though the opposite is true. There are several reasons why raw eggs should not be eaten. One reason is that they contain something which stops their digestion but which is destroyed by heat, and another is that the raw white of an egg has a tendency to poison

some people. A third reason is that an egg mixed with water often follows the short curve of the stomach and goes directly into the intestine, and is not properly acidified and prepared for intestinal digestion by the action of the stomach. The digestibility of a cooked egg depends much upon the method of cooking and preparation.

When a person is well, in the wise selection of food one need not always choose that which is most easily digested; one must become accustomed to a variety of foods, including some that have bulk for waste. When, however, a person is ill or very tired, the digestive tract should not be burdened with too much food, and at such times only the most easily digested foods should be taken.

We shall speak in a later chapter of the effect of bacteria in the mouth, that mingle with the food, and how food may thus spoil from these bacteria. And that brings up the subject of wholesome food. Food not only should be well selected and properly prepared, but also sweet, fresh and unspoiled by bacteria.

It is known to most persons that food contaminated by microbes or bacteria may cause an illness commonly spoken of as ptomaine, or toxic, poisoning. Ptomaines are chemical compounds, produced by the action of bacteria on meat, vegetables, or similar foods. In their action on animals these poisons resemble powerful drugs. Most of such toxins are destroyed by heat, that is, by cooking; but some are not, so we cannot depend entirely on cooking for protection. Food showing evidence of putrefaction should therefore not be eaten. The fact that some people are able to eat such food without apparent bad result does not controvert this statement.

How do bacteria get into food? In the case of meat, the animals may be diseased when slaughtered; or, if free from disease, the meat may have been contaminated by handling, or by washing in polluted water, or by exposure to flies, or dust. Lack of proper refrigeration permits rapid bacterial action. Contamination after cooking is also frequently a cause of illness. Meat purchased from the ordinary country butcher's wagon is usually improperly iced, and is almost invariably contaminated by flies. Food that has been cooked for some time and placed in a lunch bucket often spoils and may produce illness. Bread and coffee and milk sour quickly in such a container, especially if the bucket is kept in a warm place.

As already stated, the quantity of food that one should eat depends upon many things, but principally upon the amount of physical exercise or the labor performed in a day. Many, however, who sit at a desk or bench do not have sufficient exercise, and in their endeavor to satisfy the palate constantly eat too much. Such overloading of the stomach causes overwork of the vessels connected with the organs of digestion, and as a consequence these wear out. Too much food makes people fat, and a great deal of fat is a strain upon the heart.

Are you too stout? It is not difficult to get thin. It is principally a question of diet and exercise. Cut down the quantity of food, reducing especially the amount of bread, potatoes and sugar, and take sufficient exercise. Those who eat at all hours, early and late, making the digestive organs work a sixteen-hour shift, cannot grow thin.

Nor is it, as a general rule, very difficult for thin people to increase their weight. It is simply a matter

of additional meals and of a possible decrease of some foods and increase in others. To get thin one must have increased exercise and take away certain things from the diet. Frequent eating and less work and people grow fatter. The weight of a person can either be increased or diminished by regulation of diet and proper exercise.

As we are creatures of habit, it is essential to eat at the same hours daily. Ordinarily it has been found best to eat three times in a day. Those who work in factories, who live at a distance from their work and must therefore get up early, have breakfast between five and six o'clock, may find it too long to wait until noon to eat. In such cases something should be eaten between meals (at about nine-thirty or ten), as should also be done in the middle of the afternoon by those who do not get their dinner or supper until late in the evening. Others will sometimes go without luncheon, especially business men, thus putting too much strain upon the digestive organs at dinner. It is better to eat something at noon and less at night.

It is frequently said what is one man's meat is another man's poison. It is very often discovered that a certain kind of food always disagrees with some particular person—fish with one, strawberries with another, and so on. Anyone finding that he is made ill by a particular kind of food should avoid that food, or else go to a physician for special treatment.

Chapter VI

MOVEMENTS OF THE BOWELS.

It is said that Boerhaave, the great Dutch physician, wrote as a result of his lifelong experience, "Keep your head cool, your bowels open, and your feet warm."

Because of the almost universal overtaxing of the stomach and bowels, the old-fashioned family doctor nearly always commenced his treatment of a patient by giving medicine to produce a movement of the bowels. His experience taught him that this was the right thing to do; and scientific medicine of to-day agrees that he was right. This does not mean, however, that people should frequently dose themselves with purgatives.

Food taken into the mouth is divided into small particles by chewing. After it is mixed with saliva, it passes into the stomach, to be softened and dissolved by the secretion there, the gastric juice, and prepared for absorption and use in the body. From the stomach the food passes into the intestines to undergo more changes, and to be absorbed in its passage through them. After that which is useful has been absorbed, the unused residue of food mixed with bacteria is discharged periodically from the body, the last step in the process of digestion.

The food is sent onward by a constant wave-like motion of the intestines. The time, however, that it takes for a meal to pass through the body varies much,

and is dependent upon a number of things, as, for instance: the kind of food, its moisture or dryness; the amount of exercise taken; the weather; and the position of the body; all of which influence the rate of the transit of food through the intestines. The progress of digestion may be hindered by the displacement of organs, such as sagging of the bowels from relaxation of the muscles which should support them.

It is of great importance that food should pass through the body in a comparatively short space of time, for there are many kinds of germs in the intestines; and these germs or bacteria, of which there are generally many millions, produce poisons, or toxins as they are called. These poisons may make us ill, for they, too, as well as food, may be absorbed. If we are ill from any cause, toxins may keep us from getting well, or may prolong our illness. As a proof of such absorption the examination of urine usually reveals indican, a product made in the system from indol combined with potassium sulphate. Indol is one of the poisons resulting from such bacterial putrefaction. The fact that it passes out as indican shows that it has been absorbed into the body and that the body is getting rid of it by another channel. Different germs make different kinds of poisons, and the contents of the lower bowels are, as we have already said, largely composed of bacteria. In order that putrid materials may not pass into the circulation we must get rid of the waste as soon as possible, for even in the rectum, the last six inches of the intestine where the stools are stored, absorption takes place, as it does in any other part of the intestines. We know this from the fact that drugs given to a patient through the rectum are rapidly taken up into the system. In cases of illness, where food

cannot be taken by the mouth, a person can be kept alive for some time by feeding through the rectum.

Of late years many of the products of bacterial action on foods have been studied. Some of them act very much like drugs derived from plants. They vary not only with the kind of germ, but also with the kind of food. Certain germs acting on some foods, such as meat or fish, may make very poisonous products; but some foods, like milk, are not productive of such dangerous poisons under any circumstances. These products of bacterial action or toxins have different effects upon the body. They may cause or help to cause some diseases, and often greatly lower our resistance to others, the infectious diseases, for instance. There are many diseases and conditions in connection with illness that yield to mechanical, medicinal or bacteriological treatment of the bowels alone, when this is followed by a proper diet. Many skin diseases and disturbances of the nervous system are cured simply by making the bowels move more frequently and by changing the diet.

The amount of waste material that should be passed in a day varies with different people. A healthy person should have one or two movements every day; and generally two are better than one. With some persons three are not excessive, depending on the kind of food and quantity that is eaten, and the character of the movement whether partial or complete emptying of the lower bowel.

We can tell much of the character of a movement by its shape, color, odor, and consistency. Usually all these vary in health and in disease. Much depends upon the water a movement contains, and upon the predominance of milk, vegetables or meat in the diet.

The color varies a great deal, depending somewhat on the kind of food eaten. For instance, spinach or other green vegetables makes a movement greenish in shade —but greenish movements may also result from fermentation. The color is ordinarily brown. It may be yellow in cases in which the diet consists mainly or entirely of milk. If on a mixed diet the movements of the bowels are very light or white, there is little or no bile passing into the intestine owing to improper action of the liver or through some obstruction of the gall duct. Gases in the bowels are mostly formed by the fermentation produced by bacteria. Some of these gases are like coal gas. Some such gas may be passed from the bowels, but some of it may be absorbed in the system and may injure the blood. You may notice occasionally on going to bed that your abdomen is distended, but in the morning the distention is gone, and yet no gas has passed. In that case the gases have been absorbed. Gases stimulate the wave-like motions of the bowels, sometimes to such an extent as to cause pain.

A very bad odor from the movement means that something is wrong, that there is an excessive amount of putrefaction, and therefore of bacteria; lack of odor, however, does not mean that there is not putrefaction. Both the juices of the intestine and bacteria soften food, so bacteria in the intestine may be beneficial in helping to decompose food that has escaped digestion by other means. Hard masses may be thus softened that would be difficult to move onward and out of the intestines. Bacteria, however, are not necessary to us.

How do these germs that make the poisons get into the bowels? They may enter in drinking water, from

dust on food, from flies that alight upon food, from fingers, or from the mouth. They are swallowed with food, or with saliva alone, and thus get into the stomach. Here most of the germs are killed by the gastric juice. But if there is a lack of secretion, if too many are swallowed at one time, or if there are a great many in water which soon leaves the stomach, some of them pass on into the intestines, where under favorable conditions they multiply. So we must be careful never to eat spoiled or stale food. We may also make unfavorable the conditions for the growth of harmful bacteria in the intestines by changing the kind of germ that grows there. We must also get rid of the excessive number in the bowels by having more frequent movements. It is necessary, therefore, not only to prevent if possible the entrance of germs into the body, but also to reduce their number when they have entered.

Some intestinal toxins are made almost constantly. Thus indol, of which we have already spoken, is generally present. A noted professor of Columbia College has made some interesting experiments upon the action of indol on the muscles of the frog. He found that indol in the muscle fatigued it greatly; that is, it made the muscle tired, and muscular efficiency was reduced two-thirds by the presence of a very little indol. This shows that if a worker delays having a movement and absorbs a large amount of this kind of toxin he is not as efficient as if his bowels had moved and he had absorbed but little of it.

There are more bacteria in the intestines of those who live on meat than those who live upon a vegetable or milk diet, and consequently there are more poisons to absorb. What we eat then modifies the

number of bacteria. It is necessary, therefore, that the bowels of those who eat much meat should move frequently. It is known also that drinking sour milk or buttermilk greatly lessens the number of the ordinary germs usually formed in the intestines, and replaces them by others that are less harmful.

In this connection we must remember that people acquire disease more readily when they are tired. As intestinal poisons make us tired, we can see how irregularity of the bowels may lead to disease, and why the family doctor was right in making certain that the bowels were moved before anything else was done.

When a person is very tired, the gastric juice is much reduced in amount. So, after a hard day's work, one should rest before eating, so that some of the tiredness may pass away. Not only does the digestion suffer from lessened secretion of gastric juice, but bacteria are apt to pass alive beyond the stomach into the intestines. It is well known to those in charge of slaughter houses that the meat of animals killed after being driven a long distance does not keep well, an evidence that there is a change in the tissues. It is the general practice to allow such animals to rest a day or two before killing them for food. Experience has taught physicians that human beings lose resistance to disease when very tired.

The poisons that are absorbed not only may make us tired, but like the poisons from abscesses at the roots of teeth or around the tonsils, may irritate the inner lining of the blood vessels. Constant absorption of such poisons makes us grow old faster than we should. Years and age do not always correspond. Some people are old at fifty, others are still active at seventy or more.

Too much food and the poisons produced by bacteria also put a strain on the cells lining the intestines. The intestines fail to work properly in consequence, and as a rule there is not as much secretion as there should be, though there may be too much from over irritation.

Sometimes the bacteria themselves are absorbed into the circulation, and pass through a large vein to the liver, where they are destroyed. The liver is capable of destroying not only bacteria, but also their poisons, unless too much work is put upon it. If bacteria and their poisons are not destroyed illness such as headache or fever may result. We must remember that the working capacity of each organ is limited.

Regular movements of the bowels are therefore of great importance, for the effects of constipation may be shown in several ways. The poisons that are absorbed may produce the ailments already described, or cause rheumatism; the weight and pressure in the lower bowels from retained material may cause pains, both local and in distant parts of the body. Even an odor may come from the skin, and some skin affections are produced by constipation, while still others are made worse by it. The very fact that in some cases the taking of yeast cures pimples (acne), proves that they arise as an effect of a poison absorbed from the intestines, because yeast changes the kind of germ that grows there. Nerve pains (neuralgia) and neuritis or inflammation of the nerves, are sometimes caused or kept up by constipation.

Other symptoms and effects of constipation are dizziness; headache, particularly in the forehead; sleeplessness; a tired feeling, which includes inability to remember or to concentrate upon one's work; bad temper, and low spirits. But it must be remembered

that some of these symptoms may arise from other diseases and may arise in fact from almost any ordinary disease or even from fatigue. Some people may be constipated without having any symptoms, while still others suffer from constipation which is masked by diarrhœa, or may have alternating constipation and diarrhœa.

How can we cure conditions such as these just mentioned? Only by knowing the cause or causes at work and by trying to remove each cause, for generally there is more than one. What are the principal causes of constipation? Constipation in a person who has always been regular, requires the attention of a doctor. It may be due to something eaten, such as too many berries with seeds in them, cheese, or even milk. Habitual constipation may result from the nature of the occupation followed, such, for instance, as working with lead; or may be due to lack of exercise, or to some error in diet such as constant overeating, fast eating or irregular meals. It may also come from too great bulkiness of the food eaten, or the opposite, for food that is completely absorbed does not leave sufficient waste matter to stimulate the bowels to move. There are many diseases and conditions of the body and internal organs that cause constipation, but these causes should be sought for by a physician. Some medicines and drugs tend to produce constipation. Thus many people continually take some form of bismuth for indigestion. Some drink strong tea, which has been on the leaves for too long a time, so that the tannin acts as an astringent.

Constipation may result from other causes such as relaxation of the muscles over the bowels, or from confinement to bed in the case of chronic invalids; from

drinking insufficient water or other fluids; or from sweating too profusely. More often constipation is caused by delaying, through inconvenience or indolence, a movement when one has the desire. Deferring it until a more convenient time is principally the trouble with children at play. They are so interested in what they are doing that they will not take time to go to the water-closet, and the desire to have a movement passes away. Often in schools the toilets are insufficient in number, and are unclean. With older people occurs the desire to finish what they are doing, sewing or other work, or even reading a book. In factories the water-closet or privy is not always convenient to the work; the place may be dirty, or have a bad odor, or be badly constructed, cold, or improperly ventilated. For such reasons, one may delay going, and wait perhaps until he goes home. Sometimes when on piece work workers will not take the time to go. Farseeing manufacturers in charge of industrial establishments install modern toilets.

Sometimes an injury, such as a fissure or piles, may delay some through fear of pain. Sometimes worms or hookworms may cause trouble. But for all these causes, one must seek the proper remedy. Nothing is more injurious or leads more often to constipation than constant dosing with purgatives.

Many people have the habit of going to the toilet immediately after breakfast. But others, especially if they live at a distance from their employment, or must catch a train, do not leave sufficient time after the meal; and by the time they reach their work the desire has passed away. In the morning, especially after a warm drink of coffee, there is a little moisture in the bowels and they move easily; but if going to the

toilet is put off, and one exercises or walks some little distance to work, the moisture is absorbed. This absorbed material, as we have already stated, makes a person much less efficient.

One should always rise sufficiently early to have time enough, not only for bathing and for brushing the teeth, but also to have a movement of the bowels after breakfast, and in this single respect, at least, the day should commence rightly. Our breakfast hour should not be arranged so that immediately on finishing the meal we must hurry away. We are creatures of habit, and should above all things acquire the habit of going to the water-closet the first thing each morning. Living in a large city produces in most persons a tendency to sit up too late, reading or seeking some form of amusement, and accounts for their getting up late in the morning. If one eats the right proportion and proper amount of various foods (see chapter on food), the bowels are apt to move properly.

Those whose occupation requires them to stand or sit all day at a machine or a work table, and who do not have sufficient exercise, must find some method of exercise after work, for constipation may arise from standing as well as from sitting. Many persons do not stay long enough in the prone position in bed.

Hot weather or the heat of a work place may disturb the bowels, and one is then apt to be constipated or to have diarrhœa.

In very hot weather, especially if one exercises, much of the blood in the body goes into the vessels of the skin and into the muscles; so that less is left in the internal organs, and the intestines and the liver are apt not to work well. The bowels become more or less anæmic, so that they do not have much motion, and

this also gives the bacteria a chance to work injury, because of the stagnation. Then nature makes an effort to get rid of the offending material, and diarrhœa is produced. When, however, the material is removed, the patient gets well, if in addition he has a proper diet. There are, of course, other conditions that produce summer diarrhœa.

Constipation may be treated or cured by diet, proper clothing and habits, exercise, bathing, massage, electricity, or drugs. Drugs are helpful when properly used, but as a rule only when prescribed by a physician. For there are many kinds of drugs that move the bowels, some acting on the stomach, some on the intestines, some on the liver, etc. Some produce a watery exudation into the intestines, while others increase the motion of the muscular walls of the digestive tract. Only a physician can decide which is best. Purgative medicines that do not act well only carry undigested food further along the intestine, to rot there and make trouble by giving rise to a headache, rise of temperature (fever) or to bloating up.

Principally, however, the treatment of constipation is a matter of education, learning how to live correctly. It is not an easy matter to cure such a condition by education; on the contrary, it usually takes time. One of the difficulties in the way of cure is that people try to doctor themselves, and resort to pills and patent medicines. Another is that the cause of the constipation may not be entirely under our control; such, for instance, as an occupation that requires sitting down. One cannot always change his occupation.

It is well known that the mind influences digestion, that anger and fright affect it. It is also true that the mind has a great influence over the regularity of the

movements of the bowels. The effect of fright may be quite marked. I once witnessed an accident which illustrated this point very strikingly. An elevator in a mine fell with several men on it. The contrivance for stopping the elevator in case of accident caught and stopped it after it had fallen a distance of nearly 400 feet. In the short space of time occupied by this fall, the fear of impending death had been so great that the bowels of each man moved.

There are certain hurtful habits and practices which we have acquired as a people, in matters of both reading and eating—nervous habits in which we show a want of self-control. Some read at meal times, particularly at breakfast, taking hasty bites between paragraphs, forgetting to chew our food properly, and losing all the taste and flavor of food which are so necessary to aid digestion. We may buy each of the several editions of certain newspapers and read them on subways, perhaps standing up in a flickering light, jostled by others, thus helping to ruin our eyesight and to disturb other parts of the body, remembering but little from one hour to the next of what we read. Certain it is that very few can tell of what they have read the day before.

Some read in toilets, a habit which interferes with the proper movements of the bowels, and wastes much valuable time which should be devoted to business. Especially is this true in many industrial establishments, where short-sighted employers furnish for use in the toilets newspapers, torn or cut up, which the employees read on both sides, sometimes twice over. The time lost to production in a single day by reading these pieces of paper would have paid for toilet paper for a week.

Harmful also is the practice of eating between meals, a habit that is rapidly growing in great cities. Many eat or chew gum all the time, not because they are hungry, but just to be doing something. So from slot machines in the subway and elevated and railroad stations one may obtain candy or gum; and from push-carts and drug and candy stores, nuts, fruits, candies, cakes and soda. Often this constant eating produces ill effects. Many, for example, of those who eat chocolate, because of some peculiarity of constitution, have frequent headaches and know not whence they come.

Chapter VII

GETTING TIRED

Getting tired is a very important matter—principally because when a person is very tired, he is much more subject to disease, especially to contagious disease. We know this from experience with people, and from experiments on animals. That if very tired, both people and animals have lessened resistance to disease. We have further proof in the fact that after the death of an animal that is very tired, its flesh rapidly spoils. Think how important this matter is, especially in epidemics of pneumonia and influenza. Our very lives may depend upon not getting tired.

If one tires easily he is not able to accomplish as much work as he should. Thus a workman may not do the best of which he ought to be capable. Important as this is to the world's production and to the cost of living, it is of secondary importance as compared with our lives.

How may we avoid excessive tire and grow in strength and power to do things? To understand this matter we must learn more of man as a machine and of the working principles of the body. In the living body there is constant change. Every moment there is a wasting and a building up of the cells and tissues. Every time we use a muscle, we use up material stored for energy. In great exertion, the waste is increased, and there is, of course, more tissue to be replaced. Even when one is quiet or sleeping the body goes on work-

ing. Still the glands are secreting; the heart beats; the lungs move in breathing; still the body is manufacturing heat. It is not feasible in this book to explain how all of these things take place, and even if the attempt was made most persons would probably not understand the explanation unless they had studied medicine. So I will explain only a little as to how these changes take place.

The food we eat that is absorbed for use is carried by the blood to various parts of the body—some of it to the muscles. Here certain foods, fat, and a kind of sugar are stored as fuel. We say fuel because it is used by the muscles to produce energy and heat. It is customary to say it is burned there, because the final products left after its use are the same as if burned outside of the body.

The principal food used by the muscle is sugar. Living muscle converts the sugar into lactic acid (this is the acid of sour milk), and as we exercise some of the lactic acid is changed back again into sugar, while some undergoes still further changes. With each change heat and energy are produced, and finally the food all becomes changed into carbonic acid gas which goes out through the lungs, and into water which goes out through the kidneys, skin, lungs and other channels, the water containing dissolved in it all that is left from the food that has been used—the ashes of waste.

When we desire to use any portion of the body, let us say to walk or to lift something, we will, with our brain, to do it. The proper muscles contract, and this contraction moves the desired portion of the body. Whenever a muscle contracts, it uses up some of our oxygen. The oxygen we take in through our lungs when we breathe is carried by the red material

in the blood to the different parts of the body. Wherever oxygen is needed by the body, it is given up by the blood. The blood also takes up the carbonic acid gas that is formed from the food that has been used, and carries it back to the lungs where we breathe it out.

But often we need more energy for work than the muscles can store up, and this extra energy is stored up in another part of the body, namely, the liver. In this respect the liver is a repository of reserve energy and corresponds to a coal bin.

In some respects the production of energy in the body resembles the making of steam in a boiler, or the operation of a gas engine. In an engine the fuel may be coal, oil or gas. In the body the food is the fuel. Both the engine and the body must have a supply of air which contains oxygen; and both the engine and the body have ashes and carbonic acid gas as waste.

From this we can see that the energy or force developed by the body which means the amount of work we can do, depends very much on three things:

1. The amount of food stored as fuel in the body, and the ability of the system to use it.

2. The ability of lungs and blood to furnish oxygen to burn the fuel, and also to carry away the carbonic acid gas.

3. The ability of the organs of the body to carry off waste and other poisonous substances.

Getting tired must be due primarily to the failure of the system to do one or more of these three things. It may be due to lack of food or to interference with its storage—to lack of nourishment, in fact. Insufficient food, improper kinds of food or indigestion, all may

help to make us tired. If food is not properly absorbed after digestion so as to be of use to the body, or if there is any trouble with the liver so that food cannot be stored up, or if the muscles fail to store a sufficient amount of sugar and fat, we tire because we have not enough fuel to work with. It requires no argument to prove that if food is lacking, energy must be lacking. As for the proper kind of food, one has learned much who has learned what to eat and what to avoid. So, to avoid getting tired, you must know all about food and about the needs of the system. Some knowledge of this may be obtained by reading the chapter on food. An examination of many lunch buckets has shown that sometimes very little thought is given to the kind of food that goes into them, provided there is quantity. And sometimes the food in a lunch bucket becomes soured and spoiled before it is eaten. All this has much to do with getting tired.

The second circumstance that we must consider in connection with the matter of fatigue is interference with the carrying of oxygen by the blood to the tissues or of carrying carbon dioxide from the tissues. With the former there are four things to consider: First, a diminished amount of oxygen in the atmosphere; second, a diminished carrying power of the blood; third, a diminished lung capacity; and fourth, interference with the circulation of the blood. Regarding the first, it may be that a person works at a high altitude, for example, in mines in the mountains. Anyone who has climbed a mountain knows that the higher one goes, the more easily one tires. But this applies only to comparatively few places. It may be on the other hand, that the workroom is insufficiently ventilated, or that too many persons work in the same

room, so that there is not enough oxygen for all. The main effect of bad ventilation, especially where there are a number of people in the room, is to increase the humidity, but of this we have already spoken in the chapter on drinking water. It has been found that with regard to diminished oxygen-carrying power of the blood, there is a great difference in the number of red corpuscles in the blood of different individuals, and therefore, differences in their oxygen-carrying power. Some people have only half as many red corpuscles as others. Where the red corpuscles or the coloring matter of which they are composed are much diminished the condition is called anæmia. People with anæmia tire easily. Anæmia may be produced in a great many ways. Among these are working in too little light, an insufficient amount of iron in the blood, not enough variety of food, irregularity of the bowels. It may occur also as the after effect of infectious disease. Anæmia may be due to working where there are poisonous fumes, such as from lead, or poisonous gases.

As for diminished lung capacity, everyone knows that people affected with consumption of the lungs or any other lung disease, tire easily. Anything that interferes with the general circulation of the blood such as heart disease or tight clothing may also cause fatigue. In individuals when the body is too large, that is, in the case of persons overloaded with fat, the increase in the number of blood vessels and the increased distance of travel, make the heart pump harder, and the apex may even be pushed out of place, principally by fat in the abdominal cavity. The heart may also become enlarged because it must pump harder. For this reason fat people tire easily. Tight clothing may interfere di-

rectly with the circulation. Age, sex, climate and seasons all have much to do with the efficiency of the circulation of the blood, and therefore have to do with getting tired.

Some chemical compounds are known as acids and others as alkalis. To a great extent, these are the opposites of each other in their properties. I will not attempt to define these substances, since the newer conception of them is to be found in text books on chemistry. Both acids and alkalis occur in the human body. The blood is slightly alkaline. It tends to regulate itself and remain constantly alkaline, notwithstanding the fact that acids such as lactic, hydrochloric, sulphuric and phosphoric are formed in the body, and that others are introduced into it. The formation, or secretion of the urine helps to maintain the normal alkalinity of the blood, and much depends on the relative proportions of meats and vegetables eaten, the alkali of the vegetable neutralizing the acid formed from the meat. If the alkalinity of the blood is reduced ever so little, the effect may be serious. Such a condition is called acidosis. This does not mean that the blood becomes acid, since this never happens—but the alkali in the blood becomes reduced.

It may occur because there is a diminished alkaline supply, or because of an increased elimination of alkali by the bowels; but more often when there is an increased quantity of acid formed in the system.

It has already been explained how food is used or burned in the body. If starches or sugars are properly burned, the ultimate waste is carbon dioxide (carbonic acid gas) and water. If meat and eggs are burned, the result is the same, except that in addition there are certain other waste materials excreted in the urine,

dissolved in it. When fat is properly burned, we also get as a final product carbon dioxide. But in certain diseased conditions the result is quite different. This is notably the case in the burning of fats, that is, those fats stored in the body; and may result in the formation of certain acids not generally found in the system. In such cases the finding of what is known as *acetone* in the urine is evidence that these acids are being formed in the body. We may also smell the acetone in the breath.

When there is an abnormal production of acids (since the acids are eliminated in the urine combined with alkalis) they withdraw too much alkali from the body, and so cause a deficiency of some alkali principally bicarbonate of soda. This deficiency lessens the carrying power of the blood for carbonic acid gas, so that this is not properly taken up and removed from the tissues. In acute cases this develops great shortness of breath (air hunger), dizziness and nervous excitement.

The reduction in alkali or acidosis may occur in connection with certain diseased conditions, in fevers, some digestive troubles, diabetes, scarlet fever, pneumonia, inflammation of the kidneys, persistent vomiting and diarrhœas of children, vomiting of pregnancy, severe anæmia, shock and sometimes after the administration of ether or chloroform. It may also occur in starvation, or when a person takes diet that is salt-free or without any starches or sugars. Probably also those who eat an excess of meats. This may be one of the reasons why such persons tire more easily than those with a balanced diet. For unless carbon dioxide is rapidly removed from the tissues fatigue comes on. Even slight acidosis tends to fatigue.

The third great cause of getting tired is the accumulation of waste material in the body and its action as a poison.* There are many substances which in small quantities do no harm to the body, but in large amounts act as poisons. Accumulation may be due to working too fast, which results in a very rapid formation of the products of waste, which the blood and other organs in the system may not be able to carry away fast enough.

When a muscle is tired, there is more to be considered than that the waste simply acts as a local poison. The products of its work pass into the blood and affect all parts of the body, including the nervous system. This matter has been carefully studied by a number of able and well known investigators, with most instructive results.

It was first shown by a professor in an Italian university, that if blood taken from a quail tired by migrating a great distance across the Mediterranean Sea was put into the circulation of a quail that was not tired, the latter quail immediately developed all the symptoms of fatigue. It was thus learned that something is made during exercise that tires people. Other poisons, such as those that are made by fermentation of food in the intestines, will also cause fatigue. Prolonged exposure to cold seems to lessen resistance to disease, and may possibly be due to the tiring of the cells in the body in the rapid manufacture of heat necessary for warmth.

How, then, may we avoid getting tired? First, we must pay attention to food in following the rules laid down in the chapter on that subject. Second, the quality of our blood supply must be maintained. Anæmia, for instance, should be avoided or, if present, should be cured. Third, we must not manufacture waste any

*See also page 73.

faster than we can get rid of it. It has been found by experiment that a person may work steadily, we will say, at twenty movements of the arm or body per minute, while if the number of movements be increased to fifty a minute, he will tire almost immediately. We must determine the amount of work that can be done in a given time without fatigue, and not exceed that amount. Sometimes it may be found necessary to rest for a short time. Periods of rest might be introduced into everyone's work with advantage. We must remember in connection with rest, that a person is easily tired if he does not have a sufficient amount of sleep at night. Night is the time to build up the body. If we work faster than we can build up, more time must be given to rest and sleep.

It is important to remember that if we are very tired, all of the organs in the body are tired also, and can not work as well as usual. It has not been proven scientifically that the stomach of a tired person does not secrete as much gastric juice as it should, but we know from practical experience that when one is very tired he should eat lightly.

All of us do get tired, however, and we should try to lessen the effect of fatigue as much as possible by certain methods at our command. One method is to drink sufficient water or other fluid, so that we may rid our system of waste products, as stated in the chapter on drinking water. The second method is the external application of water, as will be shown in the chapter on bathing. Shower baths should therefore be used at the end of the day's work, not only for cleanliness, but also to relieve fatigue. Those following the rules laid down here will be less subject to disease, better

able to digest their food, and more alert mentally to enjoy their evening's recreation.

If a muscle is tired from too rapid movement or from too long continued use, or if it is forced into use when already tired, changes occur in the muscle itself from which it may take a long time to recuperate. After a double task, muscles require four times as long as normal to recover. Work that is too hard and too long-continued is harmful. Ambitious workmen doing piece work will sometimes speed up beyond the limits prescribed by nature, and thus do themselves great injury.

But we must not charge to work what is properly chargeable to other causes. Ordinary tiredness, resulting from proper effort, is beneficial rather than harmful and enables us to enjoy and digest our food, and to obtain rest and recuperation from sleep.

Chapter VIII

SLEEP

All living things have periods of rest. We sleep that we may rest. During sleep the tissues are rebuilt and restored after the wear and tear of the day. It is our period of growth. It prepares us for another day's work. That is why we sleep. Sleep is not so much a resting time for the body generally as it is for the brain. It is the resting time of consciousness. If we are not entirely unconscious, we are not entirely asleep. It is the resting time of our voluntary muscles and our senses. The eyes particularly are rested in sleep, since constantly looking at objects often fatigues us greatly.

Some parts of the body go on working while we sleep. The heart beats, and the blood circulates; the lungs take in air; the body repairs its tissues and stores up energy. The secretion of the kidneys, and the onward movement of food in the intestines, still continue. The hair and nails grow. Most of these processes, however, go on more slowly during sleep than in waking hours. As we learned in the chapter on fatigue, getting tired depends much upon rapidity of movement. Rapidly repeating a movement tires us quickly. Slow movement, on the other hand, is not necessarily tiring. The heart never stops while we live, but it rests by beating slowly.

From the time of Aristotle, who lived over three hundred years before Christ, up to the present day,

many persons have tried to explain just what sleep is: but no one has yet solved the mystery. We do know from those who have studied how the body works, something of what happens when we sleep. We become unconscious. We breathe more slowly and deeply. The heart beats more slowly, and the pressure of the blood falls. The amount of blood in the brain is lessened, while the amount in the arms and legs is increased. The temperature of the body falls slightly. The skin contains more blood, and though the secretion of the sweat glands is increased, probably the secretions of all the other glands of the body are lessened.

We also know that there are many things that help to bring about sleep. Getting tired is one, whether it is from physical work or cold, or any other cause that fatigues the body. Physical exercise no doubt helps to produce sleep by taking the blood from the brain to the muscles. But whether drowsiness is due to this, to chemicals we make when we exercise, or to using up oxygen stored for energy, we do not know. Perhaps all contribute. Drowsiness also comes after a full meal, when more blood is in the digestive organs. Warmth of the skin, darkness, quiet, lying in a soft bed, all help to induce sleep. Much depends, however, upon one's habits of life; for some get used to sleeping in a noise, and some upon hard beds.

Drowsiness is not always a sign that we need sleep. Sometimes it is due to too much food, or to a diet that is not properly balanced. It is not always a sign that we need more rest. If, after a proper amount of sleep one continues to be drowsy during the day, it is best to consult a physician.

To keep well it is of great importance that we have

sufficient sleep. We know that disease is most likely to attack us when we are tired. After we have slept, we are no longer tired. So sleep helps to ward off disease by raising the resistance of the body. It also assists greatly in the cure of disease. Often it is the turning point of an illness, and the agent that makes us better. Sometimes, however, we sleep because we are better.

Like cheerfulness, sunshine and water, sleep is one of the best of medicines. But some neglect to avail themselves of such remedies because they are not difficult to obtain, and there is no display about them. Such people are like Naaman, captain of the host of the King of Syria, afflicted with leprosy, who through his wife's maid heard of the prophet Elisha and went to him to be cured. Elisha told him to wash seven times in the River Jordan; but Naaman expected something different, became angry, and went away. Then his servants said to him, "If the prophet had bid thee do some great thing, wouldst thou not have done it?"* So we often despise simple remedies, because they are easy to obtain.

The number of hours we should sleep, and the length of time we should spend in bed, have been much discussed, but usually by persons who know little or nothing about such matters except from their own personal experience, which counts for but little. A great general is credited with saying, in speaking of the requirements of people as to sleep: "Four hours for myself, six for a man, seven for a woman, and eight for a fool." If he made the remark, it but illustrates the fact that people of recognized ability in some lines often under-

*II Kings v-13.

take to talk on subjects of which they have no knowledge.

People, in general, spend one-third of their lives in bed, and most of it in sleep. Is so much time necessary? Should we give up one-third of our time on earth for this purpose? My personal opinion is that we should.

The necessity for sleep depends upon many things. Those who have had much experience in the care of infants agree that infants should sleep fifteen to twenty hours; that youths or adolescents should have ten hours. Middle life can do with less, but old age needs the same amount as youth, because body processes become slower in advanced years. Something depends on how soundly or deeply we sleep, for there is a great difference in the quality of sleep. There are heavy sleepers and light sleepers. The length of time in bed has also much to do with recovery from wear; for although the intensity of sleep is greatest in the first hour, that short period is not sufficient for recuperation. One hour of intense sleep is not worth all the other hours.

The need for sleep depends largely upon the amount of work done during the day; the amount of wear, either mental or physical. Those that do not think deeply require less sleep than those who do. The necessity for sleep also depends somewhat upon the weather. Cold uses up our fuel and tires us, so that we need more sleep in cold weather. Many sleep poorly in damp, rainy weather because of the change in the barometer, that is, the change in the pressure of the atmosphere, which affects the caliber of the blood vessels. The pain thus produced in a chronically inflamed joint or an old injury, foretells rain. Some sleep

poorly at a high altitude in a dry climate, on account of its effect upon the circulation, until they have become accustomed to the change.

Some men and some women, mothers especially, have been able to do with very little sleep. It is the current belief that men of eminence usually need little sleep, but this is not the case. It is rather the exception than the rule. Thomas Carlyle slept little; but Archbishop Whately, Sir Walter Scott, and many others took more than the usual allowance.

Early rising is a subject that has been much talked about as one of the aids to longer life. Almost all who have lived to old age have answered "the breezy call of incense-breathing morn," but they have also gone to bed early! However, the benefits we obtain from the "early to bed and early to rise" practice have doubtless been greatly exaggerated. The hour of rising depends much upon the time we go to bed. One of the benefits of early rising consists of an early breakfast, so that when three meals are eaten in a day, sufficient time elapses between meals for food to digest.

Sleep is more necessary to us than food. Animals deprived of food may live more than three weeks, but an animal deprived of sleep lives only four or five days. Limited experiments have also been made with men, one of the results showing that loss of sleep in man causes an increase in body weight. But with increased sleep the extra weight is lost. Experiments on animals prove that if they are kept awake a long time, there is a decrease in the red blood corpuscles; they become anæmic. It is therefore to be inferred that sitting up late at night, with consequent loss of sleep, is one of the causes of anæmia. With prolonged loss of sleep, actual degenerative changes take place in the brain and

spinal cord. Many people in a great city need more sleep than they usually get. There would be less illness if everybody slept sufficiently.

If we measure the growth of plants, we find that they grow at night during their period of sleep. Their growth is in proportion to the heat and light of the previous day. For the growing child few things are more necessary than plenty of sleep. Youths grow much the same as plants. Measure a boy in the morning and again at night, and you will find that he is shorter at night after standing and exercising all day. But during the night, while he is in bed, he lengthens out, and is taller in the morning. Young people who sit up late, are a long time on their feet and have but little rest, are frequently stunted in growth and do not reach their proper height.

A point to be remembered in regard to sleep is that if one should lie down for a nap during the day, he is apt to feel cold, inasmuch as during sleep the temperature of the body falls, and the sweat glands are more active. Therefore a person should have a light covering while taking a nap.

As so much of our life is spent in bed, we should consider carefully bed, bedding, the bedroom, and its furnishings. In general, the best kind of bed is one made of metal. Metal beds are more easily kept clean, and are less liable to harbor insects. They are easily painted, are tight and rigid and do not squeak; a noisy bed may keep a person awake. It is best to sleep alone, for sleeping with another is responsible for much unrest. There are many who habitually toss and twist, mutter in their sleep, cough, snore, or sigh; and these actions disturb the sleeping bedfellow. Besides this, different amounts of covers are required according

to the state of health. More than all, "colds," sore throats, and other infectious diseases are easily communicated to a bedfellow. So single beds are better than double beds.

The width of a single bed should not be less than three feet, an added width of two to four inches being desirable. Especially is this true for sleeping out of doors or for winter. If a bed is too narrow, it is difficult to keep well covered and warm; besides, one feels more the weight of the covers. It is always best to have the windows wide open during sleep. As cold may keep one awake, there should be proper covering. In severe winter weather too many blankets, if these alone were used, would be required. So it is best to have a fairly large light quilt, which is much warmer than blankets in proportion to weight. Two woolen blankets and a quilt are better than four blankets.

Feather beds are too warm and are apt to raise the body temperature. A thick, well-made, horsehair mattress is best, except in the case of one who suffers from asthma due to horse dandruff, then cotton or some other light material should be used. It should not be too hard, for then there is too much pressure upon certain parts of the body. In order that the pressure may be relieved and equalized, the mattress should rest on springs, not on wooden slats or cords.

The size and number of pillows varies with habit. One pillow is usually sufficient. The bed should be placed, if possible, out of a draft. The floor should be bare except for a rug, so that the room can be kept free from the dust usually raised by sweeping a carpet. The furnishings should be as few and simple as possible. There is always danger of accidents from illuminating gas. An electric light, an oil lamp, or even a

candle are better. Neither gas logs, nor gas pipes should be in a sleeping apartment for fear of leakage.

As slumber prepares us for another day's work, so sleeplessness incapacitates us for efficient work, either mental or physical. People are unable to sleep for various reasons: cold feet, worry, hunger, indigestion, overeating, improper covering, sleeping in a strange bed, over-fatigue, pain, fever or other illness. Sometimes the posture in which we go to sleep prevents a proper circulation of the blood through an arm or a leg, or the head may be too high or too low on a pillow. The after-effects induced by an exciting play, or the eye-strain from watching motion pictures, often lead to wakefulness. A whole evening spent in playing bridge whist or some similar amusement requiring close attention and concentration of mind, also tends to make a restless night. The remedy, of course, is according to the cause.

If one suffers from cold feet, he should wash them in cold water before he retires, and if in feeble health, he should, after drying them, warm them for awhile before a fire or radiator.

To sleep well one must put off his cares with his clothes. Those who worry are afraid to meet their difficulties. They lack courage. The remedy for worry is simply "Don't." It doesn't do any good and sometimes makes matters worse. The trouble with those who worry is that they always expect the worst. Rather believe in yourself, in your ability to meet any situation, and take courage. Go to bed thinking only that you are going to win out.

"Think then you are To-day what Yesterday
You were—To-morrow you shall not be less"*

*The Rubáiyát of Omar Kháyyám—Edward Fitzgerald.

and go to sleep, and sleep will reinforce courage, and with the sunshine of the morning, "joy cometh." Those who are engaged in risky speculations, who stand over a ticker and lead the usual irregular business life which this involves, may expect in time to have insomnia.

Sleeplessness is frequently the fault of the stomach, the effect of some form of dyspepsia. It is well known that an empty stomach with its resultant sense of hunger will often prevent slumber. There are those who find it necessary to eat something before retiring. Under these circumstances the lighter the food the better. A cup of broth, a glass of warm milk, a cup of cocoa or chocolate, or a little weak tea, combined with a biscuit or a piece of toast, is ample. For some, simply a cup of hot water will suffice.

We find just as frequently a lack of sleep caused by eating too much, or too late. The practice of having protracted late dinners often leads to a restless night.

An after-dinner nap is not always a benefit. For the aged and children it may be necessary. But as the activity of each organ is lessened, it is probable that actual sleep interferes with digestion. It is well to rest after a meal, but ordinarily not to sleep. And two hours at least should elapse after dining before one retires. The man who digs a ditch or rears the embankment of a railroad is rarely troubled with sleeplessness from his stomach. As a rule his habits and meals are regular. But many a wealthy man hurries with his luncheon, eats too much, or goes without it entirely; and often from lack of exercise he has a sleepless night. "The sleep of a laboring man is sweet, whether he eat little or much: but the abundance of the rich will not suffer him to sleep."*

*Eccles. v-12.

Sometimes the bed covers are not in accordance with the temperature of the sleeping apartment. Sometimes they are too light, and a person is chilled. It is better to be a little too warm than too cool. For if the surface of the body is chilled it drives the blood from the skin, and this condition, increasing the blood supply in the brain, keeps a person awake. Sometimes covers are not of the right quality. Cheap blankets and quilts are often very heavy without much warmth. Their very weight annoys one. Almost everyone knows that sleeping in a strange bed will give a feeling of unrest, because we are creatures of habit. While a moderate amount of fatigue serves to induce a healthy and natural sleep, over-fatigue frequently leaves one in such a restless state that some hours of rest are required before sleeping.

From the fact that during sleep the brain normally has less blood in it, we deduce the fact that the head should be higher than the rest of the body, so as to decrease the circulation in the brain and thus favor sleep. The posture, however, can only be judged by one's self. It is well that the night clothing should be loose at the neck, so not to impede the circulation to and from the brain.

Without the advice of a physician, one should never take medicine to induce sleep. Sleep from narcotics is not natural; and while some rest may be obtained, it is not the same as that gained from normal sleep, from which we awake gladdened and refreshed. After certain narcotics one may arise with brain clouded, confused, and heavy. Recourse to such remedies is extremely unscientific. It is a practice that leads ultimately to habits that are difficult to break. Sometimes it means destroyed health and ruined hopes, poverty,

wretchedness and crime. The physician and patient should seek out the cause of the sleeplessness, and remove it so that drugs will not be needed.

Many are the plans devised to promote sleep, such as the monotony of counting, building castles in Spain, walking around the room, or sleeping with the head toward the engine, if one is in a railroad train. With women, combing the hair has been found to be of value. Sometimes massage, or sponging the body and rubbing with a coarse towel, has a good effect. Sometimes, no matter what we try, sleep, like fortune, will fly from us. Particularly is this the case if we worry about not sleeping. It is not so much lying awake that injures one as the worry of lying awake. But let us turn from sleep, and it comes upon us almost unawares. As Bolton Hall says: "Sleep, like the kingdom of heaven, is not to be taken by force." Nothing seems to be more conducive to sleep than exercise. Especially is this true if the exercise is taken in the open air. If we regulate our mode of life according to the ordinary rules of hygiene and right living, we may sleep without any artificial aid.

The great cause of restlessness and discontent in this world is inequality. People are unequal in the possession of this world's goods, unequal in strength, in health of body, in mental attainments. But one thing that even the poorest may enjoy, as well or even better than the multi-millionaire, is sleep. For one-third of a person's life he may be on an equality with the rest of the world.

As Sancho Panza says: "Now, blessings light on him who first invented sleep! Sleep which covers a man all over, thoughts and all, like a cloak; and is meat for the hungry, drink for the thirsty, heat for the cold, and

cold for the hot. Sleep is the current coin that purchases all the pleasures of the world cheap, and the balance that sets the king and the shepherd, the fool and the wise man, even."

Chapter IX

CLEAN HANDS

The Importance of Washing the Hands.

Oliver Wendell Holmes was not only a great writer and poet, but also an observant physician. For many years he taught in Harvard College, and was the first physician to call attention to the fact that disease may be carried by the hand. He did not know precisely in what manner, for he lived before the days of knowledge of disease germs.

A few years later an Austrian doctor came to the same conclusion, and later Lord Lister, after several years of lecturing and thus calling attention to the matter, made clear the first steps in preventing disease from being carried in surgical operations by the hands of physicians. That was more than forty years ago.

We know now that most germ diseases are carried by contact with persons, from hand to hand, and from hand to mouth; in this way, the secretions or excretions of one person are passed to another. Of course there are other methods of transferring these secretions, such as dust, or spray in talking; but the hands are responsible for much disease.

Forty years ago saw the beginnings of modern surgery. At that time Lister advised not only the washing of the surgeon's hands and the patient's skin, and the sterilization of all instruments and dressings by boiling, but also the use of sprays over the site of the operation and over the operator. Operations were

long and tedious, and the spray was intended to remove or disinfect the dust in the air. After a time sprays were abandoned and more attention was given to washing the hands. Finally the hands were considered so dangerous that they were covered with rubber gloves. Perhaps that is the greatest advance ever made in surgery. Before Lord Lister's time surgeons could not with safety open the abdominal cavity. The operation for appendicitis, and the wonders of modern surgery were unknown. Most patients who had inflammation of the appendix died because surgical relief could not be given.

Physicians now are taught that ordinary washing of hands is not sufficient, but that the skin must be scrubbed with soap and a brush, and the nails carefully cleaned. Chloride of lime, or alcohol with bichloride of mercury, or both of them, are used on the hands for several minutes to kill the bacteria. The accepted method of testing whether the hands are free from bacteria after such washing is to pass a sterile (boiled) thread across the hand to catch any germs that remain upon it, and then to cultivate these germs upon gelatine plates. Fortunately for us, we are not apt to be infected if some germs are left, as they are but few in number, and the number as well as the kind has much to do with infection.

A good illustration of how hands carry disease occurred when I was Commissioner of Health of New York City. A physician called my attention to a certain cook named Mary Mallon, whom the newspapers later called "Typhoid Mary." This cook had lived with a number of families, and some one belonging to every family she lived with became ill with typhoid fever. There were twenty-six such cases in

all. The Board of Health had her taken to one of the Department hospitals for observation, and it was found that the movements from her bowels were at times almost pure culture of typhoid. The only possibility of cure consisted in an operation, which she refused to have performed, and she was for a time deprived of her liberty. When another Commissioner came into office, he let her go upon her promise not to work as a cook, and for a time nothing more was heard of her. Several years later there came an outbreak of typhoid in one of the large hospitals of the city, and a very careful inquiry as to the cause led to the discovery that "Typhoid Mary" was working in the kitchen as cook. The only way in which she could convey the disease was by contaminating the food through failure to wash her hands properly. It is now customary in many places to examine for disease those who handle food in restaurants, and also instruct them in keeping their hands clean.

At the entrance of America in the great war, at the Hog Island ship yard, the surgeon in charge recognized the possibility of infection from the hands of dishwashers in the kitchen. Several dishwashers would put their hands in the same water, and some of them also helped with the food. Thus they might carry germs from each other's hands to the food either directly, or indirectly by means of the plates and dishes which had been washed in bacteria-laden water. A bacteriologist was employed to investigate the matter, and as a result hand dishwashing was suspended in all the large restaurants of the plant, and steam washing machines installed instead. Cleaner dishes were secured as a result, and less opportunity was afforded to carry

infection by means of the hands of those employed in the food service.

More recently the attention of the medical profession was again called to this method of carrying disease. Two army physicians investigated the possibility of the transference of influenza and pneumonia by the usual method of washing mess kits. In many camps, when soldiers finished a meal, they would go in line to where cans were kept for refuse to scrape away any remains of the meal, and they would then dip the mess kit in a tub of hot water, using a rag on a stick to wash the plate, knife, fork and cup. The water, generally hot in the beginning, rapidly became lukewarm; many men put their hands in the water in the washing process, and in this way the water soon became contaminated. Hands might have germs from the mouth upon them, or they might have touched some other unclean portion of the body. They might carry the germs into the wash-water, to be transferred from the wash-water to another person's hand or utensils, and from those to the mouth, and so spread disease.

These physicians came to the conclusion that most of the influenza and pneumonia in the army camps was carried in this manner, and that pollution of the water by hands was the reason of these diseases becoming so suddenly epidemic in the army; they have submitted many tables and charts to prove it. Opinions differ as to the correctness of their conclusions; but whether or not they are correct as to the exact number of cases in which infection was carried in this way, rather than through coughing, sneezing, by spray in talking, by spitting, or by dust raised in sweeping the floor of the barracks, it makes but little difference. All are agen-

cies in disseminating infection; all help to spread disease.

Since disease is so easily acquired from hands soiled with germ-laden dirt, what is the lesson that we are to learn? In the first place, a person should not put his fingers in the mouth. Everyone should wash his hands after going to the toilet, and before eating; and facilities should be furnished to workers for such purposes. In washing the hands, one should not merely put them under a faucet of running water, but should scrub them with a brush, warm water and soap, and dry them on a clean, coarse towel; for the brush and the towel both remove and destroy bacteria.

Careful washing of the hands is of importance in another connection. Many accidents occur in industry; so many that they have led to the making of compensation laws. A very large percentage of such accidents consist in slight wounds to the hand. If there is no infection from germs of disease, these wounds heal in a few days. But hundreds of wounds become infected and poisoned, and tendons may be destroyed, joints may become stiff, nerves ruined, and hands and fingers twisted and deformed. Hands that it has taken years to educate in a trade or a profession are thus rendered useless. In addition to the hardship inflicted on the person injured, thousands of dollars are lost to employers and to industry, all because of infection from dirt in and on the skin. Clean hands and a clean skin would help prevent much of this infection. It is important in addition, however, that all wounds, no matter how small, should be treated with antiseptic remedies as a precaution. Anything one touches may soil the hands, especially car-straps, pockets, or the hand

of another taken in greeting. It would be well always to wear gloves going to and from one's work as means of a partial protection. For this purpose washable gloves are best, as gloves soon become contaminated.

Chapter X

BATHS AND BATHING

Do you wish to keep always young, to live a long time, and to be able to do the greatest amount of work of which your body is capable? If so, you must bathe often, and learn how to bathe, and why. Often what we want most is close to us if we only know enough to grasp it. Like many another, Ponce de Leon sought the fountain of youth afar, when he could have found it near by.

Baths not only help to do the things I have mentioned, but are also of use to keep us clean, and may be of the greatest service if we become ill.

Let us consider all of these things, beginning with cleanliness. Of what advantage is it to be clean? First, it increases one's own self-respect, and the respect of others for us, and gives us a great deal of personal satisfaction. It removes the odor which comes with dirt and perspiration, particularly from such places as under the arms. How frequently in the cars we find ourselves next to someone whose body and clothes emit such an odor that instinctively we draw away from them. Certain nations are much cleaner than others; thus the Finns and the Japanese are probably the cleanest people in the world, because they bathe daily.

Second, we should keep clean with a view to possible accident. Nearly all persons are liable to accidents of some kind, however trivial the immediate

amount of injury may be. But through any break of the skin germs may enter and cause blood poisoning. If the skin has recently been bathed and is reasonably free from bacteria, we are less liable to suffer ill effects from an accident than we otherwise would be. Bathing lessens the number and also the variety of bacteria. But it does not get rid of all germs, some bacteria being beneath the outer layer of skin. Did you ever see or read of the care with which a surgeon washes and disinfects the skin of a patient before an operation? That is to prevent the germs on the skin from getting into the wound.

Third, we must keep the body clean to avoid disease of the skin, for many of the diseases of the skin are contagious and would never acquire a foothold if one took a bath every day. Particularly is this true when the disease is due to lice. Lice may give rise not only to disease of the skin, but very serious disease in our bodies. For a knowledge of this, however, refer to the chapter on how insects carry disease.

Fourth, we should keep the skin clean to get rid more effectually of some of our waste products which come out through the skin. We must therefore not allow the skin to become clogged with dirt that sticks in the oily secretion or dead particles of skin. The skin serves also to get rid of the excess heat we make while at work.

Water is probably the oldest remedy in the treatment of disease; and its use in illness is increasing, as we know more of how the body works. As water is such a good carrier of heat and cold, the effect produced is principally in applications of either hot or cold water to the surface of the body. It is of use in nearly all forms of nervous disease, in some cases be-

cause of its tonic and stimulating effect; in other cases because of its quieting effect. Nothing is more useful than hot water in the treatment of convulsions of infants. In such diseases as typhoid fever water is employed to reduce the fever, to get rid of the poisons made by the germs that cause the disease, to help keep a fresh supply of blood in the diseased parts, and to effect a number of beneficial results. In rheumatism, heart disease, and anæmia, it is of great value.

Water quiets pain. It can control local inflammation by controlling the local blood supply, and it affects all diseases by control of the movement of the blood, making it flow faster or slower. But in all of these diseased conditions, baths, like drugs, should only be taken on the advice of a doctor.

It is frequently said that people are just as old as their arteries. The arteries are the blood vessels that carry the blood from the heart. How do arteries grow old? And how can we keep them young?

Note carefully how arteries are made. They are tubes composed of four coats: a thin inside lining, an elastic coat, a muscular coat, and a thin outside covering. When one is young and his arteries in good condition, they are much like elastic rubber tubes. When the heart beats and sends the blood forward, an artery swells out with the blood going along like a wave. This is the pulse we can feel. Then the stretching is relaxed, and another impulse or wave comes with another heart beat, and so on. The average rate of the pulse is over seventy beats a minute. Now if the blood carries poisons in it, as it sometimes does, made by germs or by our own bodies, these poisons may inflame the inside lining of the arteries, which then become thickened. Sometimes the swelling is so

great that the artery becomes almost or entirely closed. If this swelling remains and the lining becomes permanently thicker, then the arteries do not stretch so well, the flow of the blood is interfered with, and the pressure thereby increased. Sometimes very hard and long-continued work will so increase the thickness of the muscular coat that the size of the tubes is decreased still further. Sometimes in combination with these conditions the whole system becomes abnormal. Then we find lime deposits on the teeth, and in various portions of the body and sometimes in the coats of the arteries, making them stiff like pipe stems. When this occurs, a person is really old, no matter what his age.

To prevent our arteries from growing old, and so to keep our bodies young, we must rid ourselves of poisons produced by disease or fatigue, not let them accumulate in the system and thus keep the arteries elastic. In order to understand how this may be done it is necessary to know something of the skin, of the blood vessels, and of the nerves contained in the skin.

The skin covers the body and acts as a protection to it. It contains the ends of the nerves of sensation, so that we feel anything that touches us. The skin largely regulates the temperature of the body. Connected with the skin are more than two million little sweat glands. There are also many other glands that secrete an oily substance designed to keep the skin soft and lubricate the hairs. To the sweat glands go small branches of blood vessels and with these are other vessels that carry lymph.* All these are directly beneath the skin, so that the whole surface is a network of nerves and vessels.

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*See page 214, chapter on the Heart and Blood Vessels.

The blood vessels are under the control of certain nerves that are connected with them. These dilate the vessels or contract them according to the sensation of the skin as to heat or cold. When the vessels in the surface of the body are dilated by heat, they contain a great deal of blood, and then there is less blood internally. When the surface of the body is cold, then the vessels contract, there is less blood outside, and much more in the internal organs. Knowing this, one can readily see how water, which is such a wonderful carrier of heat or cold, by being applied to the skin may alter greatly the circulation of the blood, and may affect the amount of blood in the various organs. Particularly is this the effect of a shower bath where the striking drops produce a still further and greater effect upon the nerves of the skin. Consequently, by dilating and contracting the blood vessels we can exercise them, and keep them elastic.

After a cold bath, changes take place in the blood itself. The blood is made up to a great extent of what are known as corpuscles, of which there are two kinds, red and white, principally red. It is possible with a microscope to count the number of corpuscles in the blood. That is, it is possible to count a small proportion and estimate the rest. Full blooded people have a very high count; those that are weak and have what is called anæmia, have a low count. After a cold shower there are, by actual count, more corpuscles in the blood than there were before, and this change lasts several hours. Inasmuch as the red blood corpuscles carry oxygen to the tissues, you can readily see that after such a bath we may be more efficient, particularly as partially used products in the body can

be entirely burned up. Bathing is useful also in getting rid of anæmia.

What is meant by a cold bath, is a bath in which a person is made to shiver. The best method is by means of a shower. Ordinarily in taking such a bath, it is best to commence with warm water and gradually turn on the cold water faucet and reduce the temperature of the water until shivering is produced. In this way the system is not greatly shocked. The temperature at which shivering is produced varies considerably with one's age and condition, and often varies much with the same person. The blood is driven from the surface; and when one comes out of such a bath, the blood comes back to the surface again. So the blood is redistributed in the body. But the effects produced are not only by the blood in the skin that is driven in; the cold or heat acts much more deeply than that, somewhat in proportion to the length of time of the application. When heat or cold is applied to a large part, or even a small portion, of the body, it acts on the deeper organs and tissues as well. Thus in appendicitis ice or cold water is applied over the inflamed part and acts on the deeper tissues. So in a cold shower the muscles and internal organs are all affected. When more blood enters an organ, as a rule the action of that organ is increased; it works faster. So the secretions of the internal organs are increased when the blood is driven in by cold; and when the outer portion of the body is very warm, the secretions of the internal organs are lessened.

The cold bath tends to produce an increase in muscle tone, and muscular action. The blood pressure is raised. The heart beats faster. The action of the kidneys is increased. Hot baths have the opposite

effect, though both hot and cold baths increase the amount of oxygen we use, and also the amount of carbonic acid gas that we send out.

Having learned these effects of the action of heat and cold as applied to the skin by means of water, how can we apply this knowledge for daily use?

In the chapter on getting tired, it was shown that during exercise and work certain substances are formed that make us tired. And it has been found that the amount of fatigue or tire made by work can be measured with instruments. It has also been found by actual experiments, measuring the amount of tire after work, and then taking a cold shower and again measuring it, that the shower takes away fatigue. This is because there has been a redistribution of blood in the body, diluting the poisons and moving them from where they have accumulated in certain muscles or other parts of the body, forcing them out into the blood stream, where oxygen changes their character and they are then eliminated by the skin and the kidneys. It is the same with all other poisons; showers help to get rid of them.

Frequent use of hot and cold water on the skin makes it less sensitive to changes in temperature and thus hardens the skin. A person so hardened is not as liable to suffer bad effects from a cold draft or even from wet clothing.

All parts of the body must be used or exercised to be in good condition. If a muscle is not put to any use, it wastes away. Nerves also must have exercise. And the changes in temperature made by water on the skin, especially by a shower bath, furnish exercise for the nervous system, and, when properly applied, will strengthen it.

A certain amount of blood is needed at all times in the brain, heart, liver and other organs of the body in order that they may work properly. The skin and the muscles contain, ordinarily, about one-third of the blood in the body. But if one works hard in great heat, then too large an amount goes to these parts, and the other parts do not contain enough. I feel reasonably certain that much of the trouble with the liver in very hot climates originates in this way. More often, however, sending the blood to the surface simply plays a part. Thus on the Mexican border, in 1916, on a very hot day, a regiment was ordered to march nine miles to the Rio Grande. The men wore heavy clothing, carried packs, and marched in the sun, between rows of trees that shut out any breeze. It was stated that 89 men fell out by the roadside. This was partly due to the heavy clothing and retained heat, partly to an insufficient amount of drinking water, and partly to too little blood in the vital organs of the body.

In the treatment of certain diseases where there is congestion or inflammation and possibly an overworked organ, bringing the blood to the surface by heat relieves the congestion and rests the organ. Cold shower baths may be used to overcome the effects of heat.

Chapter XI

EXERCISE

"We are not here to play, to dream, to drift;
We have hard work to do and loads to lift.
Shun not the struggle, face it, 'tis God's gift."

So wrote one of our ablest clergymen, Maltbie Babcock. Man made in the image of his maker was made for work. "In the sweat of thy face shalt thou eat bread,"* was said centuries ago, but it still holds good. Occasionally those who have inherited money, or who have made a great fortune, attempt to escape work, with just as disastrous a result as the rich man told of in the parable in the Bible. He, having acquired a fortune, said, "Soul, thou hast much goods laid up for many years; take thine ease, eat, drink, and be merry."† And he died, like many others, before and since that time, probably from high blood pressure and apoplexy, or angina pectoris, due to too much food and too little exercise. The rich man of to-day, however, has learned much. He builds a golf course and then works all day knocking a ball around to get exercise—he works in order to live.

Josephine Goldmark has tersely put it, "Work itself is of the essence of life; without it, man's physical as well as his moral nature decays. Regular, continuous labor and exertion is as necessary for the worker's health as it is for subsistence."

The Christian religion teaches that man is made in

*Gen. iii-19.
†St. Luke xii-19.

the image of his Creator. And it is to be presumed that man has attributes like Him. It was God's pleasure to create the world. And if we are to be like Him, our greatest happiness will be found in what we ourselves create. In other words, happiness is found in work. How insipid life would be without work, without the opportunity to create!

The world to-day is restless and unhappy. People are looking for position, for power, for money. While the masses have these objects as their chief aim, there can be for them no permanent basis of happiness. One of the great needs of the world to-day is increased production. This would settle some of our most urgent problems, particularly the cost of living. But to have such increased production, we must first desire it, and then work to that end.

Not only should pleasure be found in toil, but we know from physiological experiments that health also is to be gained from exercise and work. How? The human body is made up of bones, ligaments, muscles, blood and lymph vessels, nerves, and various glands and organs. Each person has several hundred muscles. These comprise 45 per cent. of the body by weight; and every movement that we make is caused by the contraction of some of these muscles. Each muscle has what is called an origin and an insertion, that is, a beginning and an ending. One end, the origin, is attached to a part that is more or less fixed, the other, the insertion, to a part that is more movable. When we wish to move a part like the forearm we must will with the brain to do so. This makes the muscles that we need to use, contract, or shorten, and the contraction moves the forearm. In like manner other parts of the body can be moved.

Exercise or work consists in the contraction of muscles and in allowing them to relax again. But the effect of this contraction of muscles is not local; it is very far-reaching, and affects the whole body. We cannot have motion of any kind unless something is used to produce it. The energy in the human body comes from food. The food is stored in various organs and in the muscles for use. So the first effect of the contraction of a muscle is to use up the stored food. We find that this is stored in the muscles, in the form of sugar and of fat. Ordinarily in making a movement we first use the sugar. This sugar differs a little from cane sugar; it is like glucose, and is made in the body from starch. We say that the sugar thus used is burned, because we ultimately get the same products after it is used in the body as if it were burned outside of the body. When we burn anything, it goes into combination with oxygen, and produces heat. And that is what happens in the body when we use or burn the stored food;—it not only yields energy but produces heat. The oxygen is brought to the tissues by the red material in the blood, the red blood corpuscles.

This using up, or burning of material also makes waste products; just as outside of the body we get as waste carbon dioxide (carbonic acid gas). This waste, the carbon dioxide, is taken up by the blood and carried to the lungs to be breathed out. So when muscles are used, the blood vessels that supply them are also called into use. The blood in them brings oxygen to the part and takes away carbon dioxide. The blood vessels are also pressed upon by the contraction, sending the blood into all parts of the muscles, and also pressing it out of the veins. When the muscles relax, the vessels again fill. As more oxygen is used by mus-

cles during contraction than when at rest, after the ordinary supply of oxygen is used more blood must be carried to them. This makes the heart beat faster. To secure the increase in oxygen from the air we must make more use of the lungs and breathe deeper and faster. These two things, the more rapid beating of the heart and faster breathing, are the first signs we notice in active exercise. After a little we notice that we grow warmer from the heat produced in the muscles. It is in the muscles that most of the heat of the body is produced. As we manufacture heat, we get rid of the excess by increased activity of the sweat glands; and the skin becomes moist with perspiration. But many other things are taking place, such, for instance, as the manufacture of waste, of which we are not entirely or immediately conscious, unless perhaps the amount of muscular work be increased beyond the rate at which we can get rid of the waste. Then it shows in acute fatigue and breathlessness.

As the heart beats faster and with more force, during active muscular exercise, more blood is sent through the internal organs, and they all show increased activity. Thus the kidneys, liver, and other parts work faster. So exercise stimulates the vital organs. These do not become greatly congested from this cause, however, as the muscles in exercise hold a great deal of blood, and this lessens the congestion of the other organs that would otherwise occur with the more rapid heart action.

As the food is used, we must have more material to take its place. The organs that have to do with storage, principally the liver, empty out their stores, and we soon feel the need of more food. So appetite is increased, and as a consequence more food is eaten and

more water is drunk. It has been found by actual experiment that exercise immediately increases the number of red blood corpuscles in active circulation; and in those who exercise daily this increase is retained, and the oxygen-carrying power of the blood has improved and increased.

The nerves carry impulses from the brain and spinal cord to the muscles and various organs of the body, and in turn carry impulses of sensation from the organs of the body and particularly from the body surface to the brain, some by way of the spinal cord. As we produce heat, the heat affects what is known as the vaso-motor system of nerves, this in turn affecting the caliber of the arteries. Thus the nervous system is exercised. Indeed, all of the body is affected, all the organs and all the tissues. Some of these effects are not immediate, but remote. For example, exercise takes the blood from the brain and other organs to the surface of the body and so relieves internal congestion and promotes sleep.

Exercise produces work for all of the body. Proper work, exercise, and training improve the quality of the muscles. Their functional power is increased; they burn better the food or fuel; and not only the muscles but the nerves and vessels connected with them are improved. Exercise within proper limitations strengthens the heart and improves the condition of the body. After one has worked and trained a good deal, one is able to accomplish without great effort what could not have been done at all in an untrained state. Exercise reduces the weight of those who are too fat. Beauty of form can come only from exercise. Through it we obtain improvement in symmetry, curves, proportion, color, and expression.

Change from a sedentary state to active work should be gradual, otherwise the heart may become dilated; particularly is this true of growing boys and girls. If one acquires acute dilatation of the heart, it will take one or two years to recover. The change from active work to the sedentary state should also be gradual. In both cases it is necessary in order to give heart and lungs time to adjust themselves to changed conditions. Excess of exercise is bad, like excess in anything else. One should avoid "stunts" that call for great display of strength and endurance. Soreness of muscles is often due to the breaking of blood vessels or to the retention of too much waste. In order to recover from exercise, eight hours sleep is scarcely enough for boys. Without exercise the amount of food eaten must be decreased.

With proper exercise, come skill, strength, endurance, courage, presence of mind, growth, development. Stimulating the muscles by the brain increases the capacity of the brain for work. There is an old Latin saying, "Mens sana in corpore sano," which means that a healthy mind is to be found in a healthy body. The efficiency of a muscle lies in its power of contraction. Muscular inefficiency shows itself in many ways. Weakness of the muscles of the abdominal wall is likely to lead to rupture; more often with advancing age to deposits of fat and consequent abdominal corpulence. Flat foot comes partly from weakness of the muscles of the leg and foot. With poor muscular development there is generally insufficient chest expansion. Proper exercise helps to relieve such conditions. Within reasonable limits the use of any part of the body increases its capacity for usefulness. Life means activity, and activity, life.

Chapter XII

SUNSHINE

Beautiful is the sunshine as it streams in through the windows, with its life and health-giving properties, killing the deadly germs of disease and banishing sickness! How differently we feel on the bright, warm, sunshiny days of June, from the dull, cold, cloudy days of November. How different is our mental attitude toward life! How sunlight cheers us! How frequently the troubles and worries that keep us awake at night disappear in the morning sunshine! It is one of the cheapest of medicines; yet how few make use of it. Centuries ago, before modern discoveries in chemistry had given us so many drugs and medicines, the ancient peoples made more use of sunlight than we do to-day, even in the building of their houses. Many peoples have been worshippers of the sun, that great source of heat and light, and have built temples to it. As we see the spring sun bring joy and new life on earth, we may in a measure understand what it meant to them.

Some of our North American Indians value the sun very highly. I never quite realized what it meant to these people until thirty years ago, when I spent several years in Arizona. One may see Indians, especially in winter, sitting with their backs bare, the shirt or waist pulled over the head as a protection, exposing their bodies to the direct rays of the sun.

For many years the curative value of sunlight was lost sight of. But recently its use has been revived upon a more scientific basis. Once again houses are

built with due attention to sunlight, both with regard to location and to construction. In our hospitals, sanatoria, and hotels, we build sun parlors.

What can sunshine do for us in preventing disease or curing it? Compare the rosy cheeks of those who return to the city after a summer vacation in the open air and sunshine of the country with the pale faces seen at the close of the winter. True, this rosy, healthy appearance is not all due to sunshine; but some of it is. And since we have learned of the germs that cause disease, we have also learned that exposure to sunlight kills them.

Many years ago I was taught by a great physician, T. Addis Emmett, that when iron was given to patients whose blood was poor in quality, the iron would be of but little use in helping to make red blood, unless combined with a sun-bath. More recently interest in the curative effects of light has been greatly revived by the experiments, work and writings of two physicians in Europe—Finsen and Rollier. Rollier describes in his book remarkable cures of tuberculosis of bones and joints. His patients, practically naked, wearing only a hat and a loin cloth, lie on beds on a veranda in the sunlight for hours daily. This treatment is continued through all seasons of the year, until the skin becomes browned and reddened and the patient cured. The treatment lasts from several months to two years, and wonderful indeed have been the results! But it takes time.

How few will take the time for health until they become ill, or it is too late!

To understand what sunlight can do for us, and its effect on our bodies, we must know something of light itself, and of its physical properties. In the first place,

light has the property of penetration; that is, it passes through certain objects, easily through glass, and to a considerable depth in water provided the water is not muddy. If you hold up your hand in the sunlight, you can see the light showing red through the fleshy parts of the fingers. So light penetrates to a certain extent the body. Some rays of light, such as X-rays or Roentgen rays, pass directly through flesh.

We can feel the warmth of the sun, and we know that its rays have the property of affecting certain chemicals. For instance, nitrate of silver in solution is white, but if exposed to light it becomes black. Photographic processes depend entirely upon this property of light.

If in a darkened room a beam of sunlight passes through a keyhole and then through a prism (a triangular piece of glass) it is no longer white, but on the wall we see the colors of the rainbow. This division of light is called the spectrum. Scientists have carefully examined this spectrum, and find that the heat rays of sunlight are at one end and the chemical rays at the other end. These two kinds of rays do not form a part of the light itself, for in sunshine there are three kinds of rays, those of heat, those of light, and those that have chemical effects. Each of these has its effect upon life and upon our bodies; and all of them may be used as medicine, either preventive or curative.

We will consider together the effect of light and of the chemical rays upon the body, for it is difficult to separate them. We do not as yet know all the effects of light in this regard, especially its chemical action. But we do know that on germ life these rays of sunlight are deadly, destroying the germs. Just how this is done we do not know. Some scientists say it is the

effect of the chemical rays, and others say it is the effect of light. But whichever it is, we find that many bacteria, such as the germs of tuberculosis, are killed in a short time by exposure to sunlight. And those kinds of germs that are not killed become weakened, and hence less liable to produce harm. Sunlight is one of the most effective of disinfectants. It is well known that exposure to the direct rays of the sun is one of the best methods of disinfecting draperies, carpets and bedclothes. It is now a fairly common practice to destroy the bacteria in water by passing it over an arc light.

The effect of sunlight on plant life is well known. For example, if grass or plants are covered by a box, so as to exclude sunlight, but not air, they become pale and weak, have but little vitality, and are unable to withstand heat or cold. It is the light and its chemical action that produces the green color of leaves and trees, and of all plants. How very noticeable is its effect on the sunflower, which turns always toward the light. Light also increases the flowering of plants.

The effect on the human body is just as noticeable. How quickly the skin is burned if exposed to the sunshine of the summer sun, even blistering if the exposure is too long. The first effect of sunshine upon the skin is to dilate the blood vessels, thus causing the skin to become red. In this dilation of the blood vessels is the principal effect for good. When one is exposed to sunshine every day, the color of the skin changes, so that it becomes pigmented, dark, and mottled; but it also becomes ruddier, because of the dilation of the blood vessels. Not only are the vessels dilated, but they become more numerous after a time, and remain so for a long while.

Sunlight, then, dilates the blood vessels of the skin,

as also do the heat rays that accompany it. These two together produce an effect upon the skin similar to the effect produced by a shower bath or by exercise, but more pronounced. The vessels of the surface may contain half, or even more than half, of all the blood in the body, and congestion of any of the vascular organs may be relieved by bringing the blood to the surface. By vascular organs I mean those that contain much blood, such as the liver, the spleen, the lungs, the kidneys, and the mucous membrane of the stomach and intestines. If there is disease of any internal organ, such, for instance, as chronic bronchitis, congestion of the liver, or congestion or chronic inflammation of any other internal part of the body, the diseased condition may be relieved by bringing a large proportion of the blood to the surface. Congestion of the brain may be relieved in this way, particularly in cases in which exercise is insufficient. And this method may be used to promote sleep.

One of the oldest forms of treating disease is to apply heat to the surface of the body, because of the close relationship between the circulation of the skin and that of the internal organs. Even if not diseased, these internal parts may have too much blood in them. When so congested, the organs cannot do their duty properly, that is to say, they are unable to perform the work for which they are intended.

Besides the dilation of the blood vessels and its effect on distant parts, we find that light alone causes perspiration, and that this process is greatly increased by the heat rays. Light is a stimulant to the body cells, and makes them work faster. By stimulating the sweat glands, it hastens the removal of waste materials.

If we place the web of a frog's foot under a micro-

scope we can see the blood vessels, and the blood which flows rapidly through them. When a ray of sunlight reaches a vessel, we see how it stimulates the flow of blood, how it hastens the work, and how it particularly affects the white blood corpuscles, making them pass more rapidly through the walls of the vessel. So light, as it penetrates, stimulates the deeper tissues to work. Both the breaking down and the building up processes of the body go on faster in sunlight. And this has been proved true by experiments on animals, some of which are kept in the light and others in the dark. Those in the light have been found to breathe out more carbon dioxide and to use up more oxygen.

Sunlight has a great influence upon the blood, not only in hastening the passage of the white cells through the vessel walls, but also in hastening the formation of the red material in the blood. We know by observation of the spectrum that this red material absorbs light. Perhaps it has an effect in the blood, similar to that exercised by the green coloring matter in plants in which oxygen is set free.

It is said by those who treat patients with light, that constant exposure to sunlight increases the growth of the hair and nails. The head may be exposed to sunlight when baldness is threatened. Inasmuch as light kills bacteria outside of the body, it may be that some of its good effects are due to weakening or killing germs within the tissue. As the blood flows through the body rapidly, it takes but a short time to expose practically all of the blood to the effect of the sunlight. It is probable, however, that better circulation has much to do with getting rid of disease germs, as it is chiefly the poisons from bacteria, and not the germs themselves, that circulate in the blood.

Not only has it a curative effect upon tubercular disease of bones and joints, but it also has a decided effect upon the growth of bone. It may be used to prevent and also to aid in the cure of rickets.

One thing that has been noticed by Dr. Rollier and others who employ light as a remedy is that pain is relieved. This is probably due largely to the effect of the heat rays, also to the destruction of poisonous waste products. However caused, it is advantageous to the patients who are made happy by this relief from pain.

We have said but little of the heat rays that accompany light from the sun. These act upon the body somewhat differently from the heat of a hot bath. The rays from the sun penetrate the body and the heat accumulates, so that the temperature of the body may be raised. They dilate the blood vessels and the rays increase perspiration. After a little while the pulse becomes quicker. The effects, however, vary much with the length of the application and the amount applied.

Both heat and light stimulate the nervous system, and by relieving congestion act also as a sedative. We get all these reactions and effects not only from the sun, but also from radium, uranium, and the electric arc light that is used for street lighting. Workmen find that the electric arc used in welding steel, in joining together steel plates, and in cutting rails, causes "sunburn" more quickly than the sun's rays. But with proper care the arc light can be used by physicians for some of the same purposes that sunlight serves.

Beneficial and health-giving as sunlight may be to us, it has great possibilities of harm. Who does not know of sunstroke? Sunshine is like almost everything else that is good for us, taken rightly and moderately a benefit,

but in excess injurious. Most drugs and chemicals used as medicines have one effect upon the body if taken in small doses, but the opposite action if taken in large doses. This is also true of foods. Thus sugar, necessary for energy, when taken in moderation is helpful, but in excess is harmful. Even virtue in excess may become vice. So sunlight, when taken rightly, warms and gives life and activity to the cells and a feeling of well-being, but when used in excess, overheats the body and paralyzes the cells and produces harm.

Sunlight is a destroyer of mildew and mold. Rooms that are constantly shut up and to which the light has but occasional access, have a musty odor. Let us take down the heavy draperies that shut out sunlight, and avoid shutters. Do not be afraid of fading the carpet.

To take a sunbath, one should lie on a cot in the sun, with the head protected from the direct rays. The first exposure should be short, but it may be increased after a while to one-half hour daily. It has been my experience that in a hot, dry climate such as Arizona that in taking a sunbath care should be taken not to sit or lie in a draft or where a breeze strikes the body. Also that in summer screens must be used to avoid the annoyance caused by flies or other insects. Glass windows shut out some of the rays we need, but are necessary in winter in order to maintain the temperature in the buildings in which we live or work.

To be certain of obtaining a beneficial result those who are ill and need the curative effect of the sun should consult an experienced physician rather than attempt any self-treatment. What we really need is more out-of-door gymnasiums, especially in the fall and winter. In summer those who can should work in a garden.

Chapter XIII

CLOTHING

The history of clothing, though somewhat apart from the subject of this chapter, is very interesting and is a more comprehensive topic than it would at first appear to be. By nature man is a naked animal. He began wearing the skins of other animals as a protection against the arctic cold and the tropical sun, against snow and sand storms. Skins also protected man against thorns, briers, sharp stones, and against injury by animals and insects. In war they served him as an armor of protection against the enemy, and in industry served as an apron against sparks from the anvil. In some localities clothing was first used as a decoration in the desire of men and women to make themselves attractive to the opposite sex, and to-day, as in the past, clothing is used to accentuate rather than to conceal the difference between the sexes. It was not modesty that prompted people to wear clothes, for modesty has resulted largely from their use. The present standard of modesty is still somewhat dependent upon the time of day, upon location, and upon latitude or longitude. Thus, as regards the time of day, the use of the modern bathing suit worn on the beach, or the full dress of women worn at the opera, while considered modest in their proper time or place, would appear highly immodest and improper if worn on the streets in the afternoon. Such standards of usage are dictated by custom.

It has been but a few centuries since people generally have worn much clothing. Even now there are races that are unclothed, and many, wearing but a breech cloth, remain practically naked. Civilized countries have laws enforcing the wearing of clothes, and artificial coverings have become a part of our lives. Race, climate, poverty, wealth and occupation or profession seem to have determined to a great extent the amount and kind of costume.

While many have written on the history of clothing, and the costumes of various races and nations, only one, Rubner, seems to have given much study to the relationship of clothing to health. His investigations included a study of the materials used, such as wool, silk, cotton and linen; but a complete scientific study has never been made. Much has been written on the dangers of corsets and high heels, and other extremes of fashion; but the form of dress has had but little scientific attention, except in relation to armies. Even the clothing of soldiers has not been designed by those who have made careful studies of how the body works.

There is at present much difference of opinion in regard to the kind of clothing that should be worn in every-day life, particularly as regards materials and methods of wearing. Naturally so, when we consider the differences among people, even in any one climate. Some persons are rugged; others are weak. There are those whose occupations call for severe exercise, while others lead sedentary lives. As clothing conserves the heat of the body, and the heat of the body comes from food, the nature of clothing must be considered in connection with the kind, quality and amount of food eaten, and in connection with the differences in digestion and absorption, and the differences in heat production in

infancy, old age and adult life. It is particularly desirable that there should be different weights and thicknesses of clothing, and the regrettable lack of information on the subject of clothing is a great misfortune of to-day. In the absence of data based upon rational study, each one thinks he knows what clothing is best for him to wear.

Ill health is often the result of improper clothing, and in this regard the selection of clothes is more important than most people think. To realize that clothing is connected with disease, we have only to think of the bowel troubles of children in the summer, and of heat stroke in adults; both of which depend somewhat upon the amount of clothing worn. In winter exposure to cold and wet favors contagious lung disease.

How does clothing affect health? In several ways. First and most important, by covering the skin, and therefore serving as a protection. It absorbs the excretions of the skin, and is concerned in the regulation of body temperature, as stated in the chapter on air. We have learned that it is very important that heat should not accumulate in the body, and that we properly get rid of heat by means of the skin. On the other hand, if the heat is too quickly carried away in cold weather because of exposure of the surface, energy is wasted, and too much of the food we have stored in the muscles and the liver is used up. In the latter case we may not have sufficient energy for all our needs, and consequently grow inefficient.

Prolonged cold lowers resistance to disease. This has not as yet been explained by physiologists, but it would seem that a reasonable explanation is that cold tires the heat-making organs, and that the very rapid pro-

duction of heat tires the cells and tissues that produce it. We know by experiments that getting tired lowers resistance to disease; and that nourishment is rapidly consumed under the influence of exposure to cold. It has been conclusively shown that fatigue and undernourishment are the greatest factors in the spread of influenza, and both are related in some degree to clothing.

As to what constitutes too much or too little clothing it is difficult to decide, for the nature and amount of the clothing worn should vary with the temperature. The particular requirements of each case must be determined by the condition of health, strong people needing clothing different from that of the sick and the weak; and also by the size of the body, as well as by exercise and occupation. The amount of clothing worn should vary with the kind and the quality of the materials of which it is made. Age is involved too. The young are more vigorous than the old, and babies feel heat and cold more than adults. Wearing clothes, therefore, becomes a matter of study, and of wise judgment on the part of each individual. We can make only general rules.

Clothing affects one's health also if it constricts any portion of the body, particularly if it prevents proper circulation of the blood; if it makes us uncomfortable and puts a strain on the nervous system, by rubbing or chafing any part, or by pressing against any bony prominence; if it interferes with the proper action of any vital organ; if by preventing the action of any muscles it limits the freedom of the movement of the body; or if it tires us by reason of the weight of the materials employed, or through the use of an unnecessary amount of coverings.

Taking up these subjects specifically, we can see some of the faults of the day; and many things show the foolishness of fashionable clothing. Thus, hats are often too tight in the band, interfering with the blood supply of the scalp, sometimes causing neuralgia and headache or making the hair fall out. Often hats have no ventilation and sometimes a hat is too heavy.

Women have given up wearing collars, but men's collars are often too tight around the neck, so that they interfere with the return flow of blood from the head the face, thus disturbing the circulation in the brain, the blands, and other important structures. Women's sleeves are often too tight at the wrist, making the hands blue, or their bloomers are too tight above the knee. Men's garters, if too tight about the leg, tend to cause varicose veins. Shoes laced too tightly help to make cold feet. Gloves are often worn too tight, to make the hands appear small. Belts may press upon the stomach, the gall bladder, or upon other organs in the abdomen, sometimes preventing proper action of the bowels, and also interfering with deep breathing. Corsets, unless very well fitted, interfere with the circulation; and lacing may press the ribs against the liver, and force the lower organs down. The muscles covering the bowels are partly for the support of the organs beneath them, holding each in its place. A corset makes these muscles useless, and if any muscle is not used it becomes flabby and wastes away. So later, without the corset, necessary support is wanting. Corsets, furthermore, often interfere with the free action of the body. The corset string, if tied in the middle of the back, may press upon the spine and rub. Corset strings should be tied a little to one side and over the corset proper. It is far better for girls and

unmarried women to wear corset waists. Shoes rubbing at the heel will cause blisters, while over a toe they will produce a corn or, at a joint, a bunion. A collar button at the back of the neck may produce somewhat similar injury.

High French heels are a strain on the nervous system, frequently affecting digestion; and it is said they may also, through the nervous system, affect even eyesight. Very short stockings, low shoes, dresses cut low in the neck in winter, decrease resistance to colds and other infectious diseases; while heavy flannels, heavy clothing, or a heavy overcoat, make one clumsy. Heavy clothing fatigues the body, besides interfering with the circulation, and the proper cooling, thus lowering resistance to disease and making a person more liable to take "cold" or get pneumonia. So both extremes are dangerous; and in wearing clothes, as in practically every other matter pertaining to health, we should adopt the old Latin motto, "Medio tutissimus ibis"—which, translated, means "You will go safest in the middle," or "In the middle course there is safety."

Men are in danger at the present day of wearing too much clothing, while women are apt to wear too little. So we repeat what we said before, that rational habits of clothing are dependent upon good judgment.

It is of great importance that clothing be adapted to the nature of the occupation. One should consider both warmth and hazard, that is danger of accident. A man near a furnace must shut out the heat. The driver of a motor car in winter certainly needs heavier clothing than a person whose occupation calls for exercise, or one who sits in a warm room. All persons should adapt their clothing to the weather, and those

who live in warm rooms in winter should wear extra clothing when they go out. Clothing should be suitable for each occasion, and should be worn loose, except in the case of workers around machinery. The danger from loose clothing near machinery is great. Thus a loose tie, glove, or sleeve may catch in machinery and draw in the body, or a finger ring may catch upon a belt and pull in the hand. Jewelry and unnecessary decoration should be dispensed with and left at home by those who work with machines.

Gloves of leather and metal should be worn by those who handle rough steel and lumber. Shoes should be made so that the toes cannot be crushed by objects falling upon them; and the soles must be thick enough to keep the feet from getting damp. Women in shops and on the farm should adopt the wearing of "overalls" with caps and comfortable shoes; and this from the standpoint of safety, efficiency and appearance. The caps are to prevent the wearer's hair from being caught in machinery, or catching fire, and to prevent dust from settling upon the head.

The practice with men of wearing knee-length drawers is not cleanly. A thin union suit of light woven material is the best. Clothing next to the skin should consist of easily washed materials, and should be changed at least twice weekly. Different undercloth-ing should be worn for day and for night. That worn during the day should be aired at night. That worn at night should be aired in the day. The night-clothes should not be rolled up and put under the pillow during the day. Some men who have pains in their shoulders from wearing thin night clothing would be relieved by wearing outing flannel night wear. Espe-

cially does this refer to the average man, who is much more heavily clothed over the shoulders in the daytime than at night.

Because of the evaporation of water and the consequent carrying away of heat, wet clothing is dangerous and should be changed as soon as possible. The principal things to consider, so far as materials are concerned, are color, porosity and the way in which the material absorbs water and gives it up.

Some study has been made of the materials of clothing, and some attention has also been given to the kinds of weave and the color of the materials. This all relates to heat and cold. Color has to do with the rays of the sun, both as regards the heat and the chemical rays. Almost everyone knows that black is warmer than white. And clothing is needed to shut out the chemical rays. Where light is strong, a black silk shirt worn under a white linen coat is quite comfortable. The question of the porousness of clothes is one of weave, and porous clothing is warmer than that which is tightly woven.

The kind of material should be decided largely by its power to absorb moisture from the body and to give it up quickly. Linen radiates heat nearly six times as quickly as cotton, and gets rid of heat ten times as rapidly as wool. Between wool and linen come silk and cotton. So the order, in retention of heat, is wool, silk, cotton, linen. Wool, therefore, is warm, and linen is cool.

To understand, then, what kind of clothing to wear, one must understand the conditions that clothing has to meet—climate, health and work. This fact alone shows that one cannot rely on any one kind of material or patent system of clothing. Neither always wool

nor always linen, no matter what the weave. People generally have paid thus far more attention to fashion and custom than to health. Habit and custom are sometimes opposed to individual needs. It is perfectly possible to combine healthful with becoming attire.

Chapter XIV

CARE OF THE HAIR

The early recognition of disease is perhaps the most important thing in its cure. Certainly it is true of tuberculosis and of many other common illnesses. If we recognize the beginning of disease, provided we take proper measures, generally we can succeed in its arrest or cure.

This is true of baldness. But, as a rule, people pay little attention to it in its first stages. It is only when one has lost a goodly portion of his hair that he will try to bring it back; and then he will make a great effort to save the remaining portion. He will consult his own barber, perhaps several barbers; will ask his friends; and then will try the well advertised patent medicines that claim to cure baldness. Then he will consult his family physician, who may know but little on the subject, and is not generally much interested in matters that do not concern serious ailments. Possibly he may consult a specialist, but not as a rule; because he does not know that such matters belong to specialists in diseases of the skin. Even if he does, the skin specialist is often interested only in venereal diseases, and the patient expects a single visit or a single prescription to cure him. So the case remains uncured, and the affection progresses.

The great secret of keeping one's hair is to keep the scalp clean; that is, to prevent dirt or germs from getting upon it, especially from the head of someone else;

and also to wash it properly. It is necessary also to keep the scalp well nourished; for baldness is apt to be accompanied by, and is partly due to, a wasting of the tissues below the skin of the scalp.

The hair catches dust and dirt from the atmosphere as well as the waste of the skin of the scalp. Much of this we can see, but there are those, especially men, who, before brushing the hair wet it by means of the hand, and leave many bacteria from the hand upon the hair. The hands should be washed before being used to wet the hair.

One sees comparatively few bald-headed women. The principal reason is that they take better care of their hair, and wash it more often than men do. The Scriptures say: "If a woman have long hair, it is a glory to her." Because she desires to make herself attractive, a woman does more to keep her hair than a man does. And she must of necessity take more care of it because it is longer.

Hair is not only a personal attraction, but it is also a protection. It protects the head against the weather, the sun, and injury from falling objects. A beard, now seldom seen, might prove a great protection in severe weather and cold climates, particularly as it covers a very necessary gland in the neck as well as important blood vessels and nerves.

The luster of the hair and its thickness depend not only on the care of the hair itself, but also upon the condition of the body; that is, whether we are well or ill. There are many diseases which affect the whole system and which also affect the hair. After some of these, such as typhoid fever or erysipelas, the hair may fall out, though it generally grows again. Almost any infectious disease of the whole body injures the hair

also. Particularly is the hair injured in wasting disease of the thyroid gland in the neck. In this case the hair becomes brittle and breaks off.

Each hair grows in a depression in the skin. Opening into the sides of these depressions, near where the hairs come out, are very small glands that secrete an oily substance which lubricates the hair and helps to keep it in good condition. These oil glands may become diseased, and then they secrete either too much, or too little. The secretion depends somewhat upon the general condition and nourishment of the body, and largely upon the kind of food eaten; particularly so, where there is insufficient secretion of the skin.

Of the local diseases, dandruff, to use the popular name, is the most common. This should be treated by a physician, preferably by a competent skin specialist. Washing, in itself, is not usually sufficient to cure it. Generally the external application of drugs is necessary, and sometimes internal medication. It requires a great deal of patience to effect a cure. Dandruff is one of the principal causes of baldness.

Constant nerve strain, or any great shock to the nervous system, may also affect the hair and make it fall out, or may tend to whiten it. It is not true, however, that a person's hair turns white in a night, which seems to be a popular belief. The color, red, yellow, brown or black, is usually inherited, and the same may be said of curly or straight hair. In such things we take after our parents. It is also true that the tendency for hair to turn white early is an inherited trait.

Cutting the hair is a matter of personal appearance, and of individual taste rather than of health. There is a popular belief that cutting hair helps its growth. This is doubtful and probably not true. To keep the

hair and scalp clean, the head should occasionally be shampooed. But the frequency of this treatment depends much upon the individual, his occupation, whether his hair gets dust or dirt in it, and the amount of natural secretion of the scalp. In general, perhaps once a month will do; but the hair should be washed frequently, and combed and brushed at least twice daily. It is not necessary in a shampoo, to use very strong soap or other materials. In other words, it is not necessary to destroy the hair or discolor it in order to clean it. Shampooing is often overdone, and sometimes underdone. Occasionally the use of crude oil seems to be of great benefit. The oil is first put on, then the scalp is massaged, after which the oil is removed with soap and hot water.

Massage of the scalp is often a great aid in keeping the hair. It keeps up the circulation in the scalp and this tends to avoid the wasting changes already spoken of. It is also of aid in helping to cure certain diseased conditions. It is unnecessary, however, to be brutal in applying this remedy.

Washing the hair at home can ordinarily be done without soap and should be frequent. When one has short hair, which can be dried sufficiently with a towel, washing may take place daily. No harm comes to the hair of those who take daily shower baths. For those who have not this advantage, putting the head under a faucet and using first warm water and then cold answers very well; or even holding the head over a basin and using a wash cloth. It is not necessary, and it is unwise, to put soap on the head every time one takes a shower; for this removes too much of the oily material.

Fashion in combs and brushes does not always make

them serviceable. Neither a comb nor a brush should be so expensive, or made in such a manner or of such materials, that it cannot be properly washed, and disinfected. A comb for a man should have shorter teeth than that for a woman, but the teeth of neither should be sharp, as sharp teeth may scratch the scalp. This is the danger of metal combs. Brushes should have good bristles. It pays to buy good ones. Each member of the family should have his own brush and comb, just as much as his own tooth brush. Preferably the brushes should differ in shape, color and materials, so as to be easily distinguished. Combs and brushes should be washed frequently and thoroughly with soap and hot water.

A woman washes her comb and brush more often than a man does. As the brush of a man catches only short hairs, the necessity of cleaning it is not so apparent, and so it is seldom cleaned. The necessity of washing brushes and combs has been made much more apparent since the sanitary supervision of barber shops has come under Boards of Health.

The kind of hat that a person wears has much to do with healthy hair. With all hats it is a question of pressure on the scalp, especially when it presses on the entire circumference affecting the blood vessels and nerves. Pressure from the band interferes with the circulation. It matters not whether it is a soft or stiff hat, it is a question of the band as well as the shape of the head. A round head, so shaped that the pressure is applied at all points, is more apt to be bald. Here again, as a rule, a woman's hat is better than a man's, though sometimes we see a tighter band upon the former than the latter. This leaves a sharp red line across the forehead when the hat is removed; and may

not only seriously affect the growth of the hair, but also produce neuralgia. In women's hats there is more often change of the hat line, with different hats and varying seasons, when the styles change, thus lessening the evil effects of pressure applied always in one spot.

For those who have dandruff or any communicable disease of the hair or scalp, it would be well to have a couple of inside washable muslin linings to the hat, which could be changed frequently. In cities there are many places for the renovation and cleaning of hats. At such places gasoline is generally used for cleaning purposes, and the use of steam is an excellent disinfectant.

Chapter XV

THE CARE OF THE EYE

Only those who have lost the sight they once possessed can appreciate fully what blindness means. By our sight we are able to work; by sight we walk; by sight we obtain most of our pleasures; by sight we get the greater part of our education. Sight permits the education by which we become acquainted with the wonders of nature—trees, flowers, rivers, lakes, seas, mountains, valleys; and with the beauties of the heavens—clouds, sunsets, stars. Upon sight depends our knowledge of animals, and of people, the ability to distinguish their varying moods by the expressions on their faces, to recognize the faces of our friends amid thousands of human beings. Through sight we learn of size, of distance, of color. By sight we read; and books, newspapers and pictures are perhaps the greatest source of education; particularly is our education enlarged and our pleasures increased by the present day moving pictures, within the reach of all.

How much of the beauty of the human face comes from the eye and the muscles that surround it! How the eye may express at different times anger or love, laughter or weeping, joy or sorrow, or interest in conversation, or the flash of eloquence in speaking! How often character shows in the eye, in the shifty eye that is unable to look at you in falsehood, or in the clear steady glance of truth. How much the eye means to both the professional man, and to him who performs manual labor!

The eye is often spoken of as the window of the soul. It is a window through which the physician who can read it aright may learn much of the health of the body, and through which he may be able to recognize many diseases. Through what is called an ophthalmoscope, a silvered mirror with a hole in the center, he may see the back of the eye. Here he may read many things, for many diseases register their changes there. So, also, the action of certain drugs shows in the eye, as does excitement or fear. Even the color of the eye may show racial and inherited disposition to disease. And not only does disease of the body show in the eye, but disease of the eye affects the body; and nausea, vomiting, headache, and many bodily pains may result from eye strain. In order to understand these things we must know something of the structure of the eye itself, and the work it is called upon to perform.

The eye lies in a bony cavity called the orbit, which is very strong above and on the outer side for protection against injury. In this cavity with the eye are a number of muscles attached to the bones composing the orbit, and also to the eyeball. These muscles at will move the eye from side to side, up and down, or in any direction that may be needful. Covering the front of the eye are the lids, fringed with hair, to keep out dust, and to shut out an excess of light. Above and in the outer side of the orbit is a gland that secretes the tears which keep the eye moist and lubricate it. And in the inner corner is a duct with two little openings to carry away excess in moisture and waste matters.

The eye itself is nearly round, and is divided into two chambers, one in front and one behind, with a lens in between. These chambers contain fluids. The eye has three coats. A small muscle regulates the

shape of the lens, as the lens is elastic. It is made in this way so that we may look, or focus the eye, at objects near by or far away. Over these muscles and a part of the lens is a curtain, known as the iris, leaving an opening in the center called the pupil. The iris gives color to the eye—blue, gray, brown or black. The size of the pupil changes constantly, according to the light, so that we can see the pupil grow large or small. And not only light, but disease, drugs and excitement change the size of the pupil. Lastly, the eye is well supplied with blood vessels and nerves.

The eye may suffer injury from light, from heat, from a blow, from a foreign body, from drugs or chemicals, from disease of the eye itself, or from disease of other parts of the body; while some eyes are defective at birth.

There is no better illustration of the value of preventive medicine than in prevention of disease of the eye, and of blindness. So easily is the eye affected that perhaps half of all people have some defect of sight. Yet when we consider how we use the eye, and how little thought we give to it, the wonder is that eye disease is not commoner.

Certain defects of the eye are common. To be what is called near-sighted (myopic) is especially noted in young people. To be far-sighted (hypermetropic) is more common in old people. Both of these defects seem, to a certain extent, to be inherited, just how much, we cannot say. It would be necessary to examine the parents and grandparents in hundreds of cases to be certain of such knowledge. It seems easier to blame parents for such troubles than to take the blame for our own shortcomings. Even if such troubles are inherited, there can be no doubt that training and

treatment may largely overcome the original defects. More often short sight, which is so common in older school children, is acquired by other causes, but how? And what are the things that strain the eyes and so injure the sight? What must we avoid?

The first thing to consider is light. Every one knows that too strong a light hurts the eyes and is blinding. If we look directly at the sun, or continually at snow upon which the sun shines, or at an electric arc, or into a furnace of molten metal, blindness may be produced, temporarily at least.

Those who motor know that constantly looking at a bright road is very trying to the eyes. So, if one wishes to observe an eclipse of the sun, or to use an electric arc in welding, or to work around open hearth furnaces, one must use smoked or colored glasses adapted for the purpose in order to preserve the eyesight. While motoring on white roads in strong sunlight, one should use similar glasses, of which there are several kinds, to reduce the glare.

Babies' eyes need to be shielded somewhat more from the light than those of adults, for the color of the iris which shuts out some of the light, is not fully formed at birth.

But other things not so striking are of almost as much importance. One should not read a book with the sunlight on the page. In reading or working one should sit or stand with the face partly turned from the light; being careful that the body does not shade the work, or the page in reading or writing. The best light is daylight. No artificial light can equal it. Many persons, however, are forced by their occupation to use artificial light. Such light must be bright enough to enable one to see well, for it is just as foolish to use

too strong a light as it is to try to work or read or sew in a light that is dim; those who read on dimly lighted trains are laying up trouble for the future. One should not go from darkness into light too rapidly, as is sometimes done by those who get up in the night, push a button, and flood the room with light. It is also of importance that light should be steady and not flicker, and that the object we look at, such as a book, should not shake. This is another reason why we should hesitate to read while traveling. When we desire to read on a train, it is often best, if the light is sufficient, to sit next to the aisle and away from the window.

The paper of which books are made and upon which we write should not be glazed more than is necessary. It would probably be better for our eyes if it were dull tinted, but this is seldom the case. The print should be of good size and regular. It should be larger for children than for grown people. The very small type used in certain books, especially those that contain much reading matter, should never be permitted by state authorities.

Small type is a very great strain upon the eyes. I cannot condemn too strongly the making of books in pearl, nonpareil or brevier type. These sizes are now known as 5 point, 6 point and 8 point. Any type smaller than long primer should not be used, except for references or notes. It is better to pay more money or go without the book than to risk one's sight. Similarly there are certain dangerous occupations that should be discontinued, and which will be in time by high insurance rates under compulsory insurance.

The distance of the book or work from the eye is of great importance. The desks of school children, bookkeepers, stenographers and typists, and the tables of

those who write or do fine work, sew or make lace, should be of the right height, and the seats arranged accordingly. The work should be far enough from the eyes. Many employed at these or similar occupations have trouble with their eyes from the steady strain of near-by work.

Eyes were made to see at a distance, and constant looking at near-by objects is a strain. To see things close by means to use the muscles attached to the lens.

In this connection it is well to speak of overworked eyes, a condition that arises from looking too long at one thing. It is well, if possible, to have a change of occupation, or change of work—to look up from our work—or out of the window—not to read or sew or do one thing too long. Even to gaze too long at any one color fatigues the eye. It is the same in writing, if one writes his name over and over again, signing stocks and bonds or other papers, he is apt to have a cramp in the hand; but writing letters in which one does not immediately repeat the same word, does not tire one in the same way.

We demand more work of the eyes than of almost any other part of the body. As in the case of the heart, the nourishment of the eye is such that it takes much to tire the sight. We must remember, however, that every part of the body has its limit of endurance.

Where the eyes do not focus properly, where the lens is not quite right in shape, and where one eye differs much from the other and their use is prolonged, the eyes and the brain become weary; the whole body is affected. This occurs often on trains, where there is constant change of focus and we look out of the window, rapidly changing from object to object, now near, now far away, until car sickness is the result. This

differs much from seasickness, which has principally to do with disturbances in the ear. However, in both cases we must remember that with those not used to travel the excitement of the journey, fatigue in getting ready, and changes in kind and amount of food, are predisposing causes. This also is true of motor rides; constant watching of the road and too long a ride may induce headache and body pains, and even vomiting may occur. This is often made worse by improper clothing. So also reading too long, particularly at night, after one has used his eyes all day at fine work, is harmful. Often upon leaving a place of amusement with moving pictures and a flickering light, one may feel as if he had rheumatism, and will attribute it to sitting still too long, whereas the fault may be fatigue of the eye.

Especially is over-use of the eye apt to cause headache—but we must always remember that there are many other causes of headache besides eye strain. It is suggested by one writer that misuse of the eye is sometimes a cause of dreams and insomnia. A thorough examination of the eyes, and properly fitted glasses, may relieve the headaches and possibly other conditions. Glasses should be used early by those who need them. We should first find out from examination by an eye doctor just what the eyes need in the way of glasses, and then have an optician make and fit them properly. As eyes may become tired simply from over-use, we must try not to do too much in any one day.

If a child is cross-eyed, one eye is not being used. This eye is rapidly failing in sight and may reach even one-tenth of the normal. To correct this, the child, even if very young, should wear glasses.

As we have already stated, the eyesight depends much upon the health of the rest of the body, and there is no part of the body, no matter how remote, that does not to some extent influence sight; even the wearing of high heels affects the nervous system and consequently one's vision. Because many diseases of other parts of the body affect the eyes also, sometimes a physician who is an eye specialist, while examining a patient for failing sight, is the first to discover serious disease of some other part of the body. Thus he may find disease of the kidney (Bright's disease) showing not only in the back of the eye, but in puffiness of the lids; or disease or disturbance of the liver, as a result of which often the white of the eye is yellow with jaundice; or he may find hardening of the arteries, showing advancing old age and the danger of apoplexy. Again he may see changes in the back of the eye, and perhaps even little hemorrhages caused by anæmia, a change in the blood. Sometimes such hemorrhages take place in women who have convulsions at childbirth and permanent black spots are the result. Happily, such events are rare.

In some cases, where one's diet consists of but two or three kinds of food affording not enough variety, and one does not eat sufficient protective foods, such as milk, fruit juice, or green leaves, we find serious eye disease (xerophthalmia). Such diseases may readily be produced in small animals by restricting their diet. Or again, where too much food is constantly taken, with too much starch or sugar, and there is too little exercise, a person gets diabetes, a disease marked by the presence of sugar in the urine. In this disease changes may occur in the muscles that affect the lens, or a change may take place in the lens itself; cloudi-

ness results, which is known as cataract. Ulcer of the cornea, the outer coat in front of the eyeball, may also come from some peculiarity of constitution relative to some particular food.

Almost everyone knows that measles may give trouble with the eyes, and that the room must be kept somewhat darkened for measles patients. Formerly smallpox caused much blindness, but vaccination has remedied this in highly civilized communities. Before the use of antitoxin, diphtheria generally affected disastrously the nervous system, and even yet the nerve of sight may be seriously affected with the rest of the system. So also in the cases of scarlet fever, typhoid fever and tuberculosis; in fact all infectious diseases affect the eye to a certain extent, and sometimes also diseases of the brain and spinal cord. In some forms of goiter, when a gland in the neck, the thyroid gland, is enlarged, the eyes fairly bulge from the head, and it is difficult to close the lids over them.

Venereal diseases may seriously injure the sight. Syphilis does this by its attack upon the nervous system, and gonorrhea, by being carried by the fingers from the genital organs to the eyes. This latter is always serious, and not infrequently causes loss of sight. Blindness of babies almost always comes from this cause. The baby acquires the disease in such cases in its passage into the world, and neglect of the physician or midwife to recognize this and care properly for the baby's eyes will result in blindness. Sometimes disease of the skin may be communicated to the eyes, but generally to the lids. But herpes, which is like a fever sore that comes on the lip, may also occur on the eyeball.

Still further, diseases of the ear, nose and throat,

or of the teeth, may be communicated to the eye. We have learned in recent years that the teeth are often the cause of eye disease—and abscesses at the roots of teeth may injure the eye by reaching it through the circulation, and may even destroy the eye by extension to it. So, one of the important things to remember in the care of the eye is to avoid getting sick. If, however, we do become ill from any of these diseases I have mentioned, these that especially affect the eyes, we must exercise the greatest care of the eye until we have fully recovered. We are apt in convalescence from disease to pass our time in reading, and we may easily use to excess our eyes thus weakened.

Certain drugs taken internally have a decided effect upon the eyes. The use of tobacco in smoking affects some. The first symptom in these cases is cloudiness of vision; after that recognition of colors is interfered with. People who are thus affected, if they continue to use tobacco, grow worse. The effect of tobacco varies much, and it is only in a few cases, chiefly where a pipe is smoked, that it seemingly injures the sight. But in these cases smoking must be stopped.

Belladonna greatly dilates the pupil, and morphine contracts it so that it becomes as small as the head of a pin. Other drugs also affect the pupil. Quinine used for malaria, salicylic acid used for rheumatism, and male fern and santonin used for worms, all in large doses, may affect the eyes. Such drugs then should never be taken without the advice of a physician. Yet there are many who are accustomed to dose themselves frequently with such dangerous remedies because they know no better.

The most dangerous of all is wood alcohol, or as it is sometimes called, Columbian spirits, or standard wood

spirits. It does not take much of this to produce death. Even fumes arising from it when used in industry will affect the sight. It destroys the optic nerve. Only one teaspoonful may and probably will take away the sight forever. Recently we have heard of its being used for making whiskey; and numerous deaths and cases of blindness have resulted. Unfortunately, ignorant and unscrupulous persons have used it in making medicines, especially patent medicines and liniments. It has also been used for making bay rum. The symptoms of wood alcohol taken internally are dizziness, nausea, vomiting, headache and blindness. It is to be regretted that the manufacture and the sale of wood alcohol are not more restricted by law, and the laws better enforced.

Much may be done for the blind—but that is outside of the purpose of this book.

Inasmuch, then, as the eye is so affected by various diseases of the body, if there are headaches or black spots before the eyes, or if the sight has changed or failed in a way that causes anxiety, it is well to go at once to an oculist rather than to an optician or optometrist. The cause of the defective vision may be due to some internal condition which the optician, no matter how excellent he may be in the making of glasses, could not discover or deal with. Cases are often found by physicians where the cause of failing vision has remained undiscovered because the interior of the eye was not carefully examined with the ophthalmoscope, and the headaches or blur were wrongly attributed to the need of a change of glasses. The optician may be perfectly able to recognize the errors of refraction which have to do with glasses, but he should not be expected to make diagnosis of the con-

ditions affecting the nutrition and health of the eye as related to the general system, any more than a druggist should be expected to prescribe for symptoms of which he cannot know the full significance.

The lids which cover the eye are lined with mucous membrane. This mucous membrane is often the site of inflammation caused by germs of disease. The germs causing such inflammation get on the inside of the lids from fingers, from dust, or from any article that is contaminated, such as a roller towel. Sometimes flies feed around the eyes of sleeping children, and in this way germs may get into the eyes.

All inflammations of the lids, however, are not due to germs. Eye strains, smoke, light, fumes, or gases may inflame them. We all know the effect of tear gas in the recent war. I have already spoken of the most important inflammation of the lids, from a venereal disease (called in babies ophthalmia neonatorum) and the importance of early treatment and prevention.

Another very serious disease of the lids which is communicated from one person to another is called trachoma. In this disease the lids become granular and rough, scarred and out of shape, and the surface ulcerated. Sometimes the eye becomes like ground glass on the outside, the cornea. This disease, trachoma, like influenza, comes to us from the far East. It is very contagious, especially through fingers, towels and wash basins. It is now common in this country, in school, in mine and in mill. To resist the disease, one should be careful to do the things advised in this book; to breathe fresh air, to have sunshine, and to get sufficient sleep. To avoid contagion one should wash especially the hands, and keep the nails clean. All roller towels should be abolished, and all handkerchiefs,

towels, bed clothes, and pillow cases used by those who have the disease should be boiled.

Another infectious disease of the lids is pink eye, and there are styes and still other diseases of the lids, as well as diseases of other parts of the eye; for all parts of the eye are subject to disease. These other diseases are numerous, such as cataract, glaucoma, iritis—but it is unnecessary to name them all, for in case of trouble with the eyes from any cause whatsoever, one should visit a physician (oculist). Two great dangers attend inflammation of the eye: absence of treatment until it is too late, and improper home treatment, such as poulticing, and dropping into the eye milk and other remedies prescribed by neighbors. The only thing to do is to have an eye doctor, and to call him in early.

Many thousands of eye accidents happen each year. Frequently the result of these accidents shows that most of them could have been prevented. I say most of them, because in such a catastrophe as the Halifax explosion many eyes were injured by the breaking of panes of glass while people stood looking out of the windows. Such a disaster could hardly have been foreseen, or the necessary precautions taken.

Injuries to the eyes come from a variety of causes. They may occur from knives, forks, scissors, hat pins, pens, pencils, sharp stick, any sharp tool or instrument, a branch of a tree under which one is walking, the glass of a wind shield in a motor car, a shot or a dart from a toy pistol, or a finger nail. More common are injuries due to foreign bodies in the eye, such as a cinder from a locomotive or chimney, or dirt from the street carried by winds, i. e., horse manure in March winds. Or again the eye may suffer from contusions

made by a baseball, a golf ball, a blow from a fist, from kindling wood that is being split, or from a door or other object run into in the dark.

Still another class of injuries to the eye results from burns. These may be from direct heat rays, or from the splash of molten metal or flame or steam, or from chemicals, such as strong acids. Not uncommonly iodine is dropped in the eye by mistake for argyrol. Most of these accidents occur in industry. They are largely the result of lack of thought, carelessness, fooling and horseplay, such as tripping a man up, wrestling and sparring, or are due to hurry or disobedience to rules.

Hurry is one of our national traits. We acquire as children the habit of putting off, and do not give ourselves sufficient time to accomplish our task. Hurry is one of the causes of motor accidents. We hurry to catch trains, and hurry to the office, when we could just as well arise five or ten minutes earlier in the day. Perhaps it is partly due to climate, but no matter what the cause, we should try to overcome the habit. Haste means waste.

Children should early be taught the value of the eye; then, when grown up, they will be more apt to keep in mind the dangers to which it is subject. No amount of compensation pays for the loss of an eye.

Goggles to protect the eye should be used in all industries where there is danger to the eyes from flying particles or burns. But workers will not always use them. This is often due to carelessness, and sometimes to the fact that the goggles do not fit or are not made correctly or are uncomfortable. Goggles for those who do chipping and blowing out of small pieces of metal, and for those who do drilling should have metal sides,

perforated for ventilation, otherwise perspiration and moisture will cover the glass and prevent clear vision. When one has any defect of eyesight, the glasses in the goggles should correct it.

The intense light and heat given off from blast furnaces, open hearths, crucibles, welding and other processes with molten metal require special colored glasses. These must have proper lenses. Strong ultra-violet rays, and infra-red heat rays are grave dangers to the eyesight. Where the face also must be protected, as in electric welding, or pouring of babbitt or other metal, it is necessary to wear a mask or helmet. Care must be taken in these cases to have correct colors, and correct lenses for the eyes. Sometimes it is the passerby who is injured. One should never stop in the street to watch the chipping of stones or of sidewalks.

Foreign bodies usually are found on the surface of the eyeball, or on the under surface of the upper lid. As a general rule, if a cinder or speck cannot be removed with a clean handkerchief, by pulling down the lower lid, or by bathing, a physician should be consulted. If one cannot be secured, then it is proper to turn over the upper lid while the patient looks downward. To take a foreign body off of the eyeball one may use a wooden toothpick covered with a little cotton. Needles or steel instruments should not be used except by a physician.

Every factory should have a first aid room for such cases, and not leave the cases to be treated by a fellow workman. The use of the tongue for the purpose of removing a foreign body is a dangerous practice on account of infection from the mouth.

It is far better to wear spectacles instead of eye

glasses, as they are more apt to focus properly. One of the most important things is not only to have properly fitted glasses but also to keep the lenses clean. Dirty lenses are a cause of eye strain. They should be wiped and polished often, every time they are put on, and in many occupations involving steam, dust, and sweat, they need to be cleaned oftener.

Chapter XVI

THE IMPORTANCE OF THE CARE OF THE MOUTH AND TEETH

It is often the simple and everyday things in life that count the most. Certainly it is so in the care of our bodies. It is particularly true of the care of the teeth. Though much has been said of late about the teeth, and though brushing the teeth is being taught by health boards and schools, few realize or know as yet the full importance of the matter.

How many thousands of people have decayed teeth. That their teeth decay late in life may not be wondered at, but the medical inspection of public schools shows that more than three-fourths of all school children in the United States have dental disease. Yet such disease might be avoided.

Do not think that decay of the teeth is simply a modern ailment. It is not new to the human race. Skulls of Egyptian mummies and of other ancient peoples give evidence of abscesses about the mouth, and teeth show cavities and decay. Is it not time we kept the mouth clean and saved the teeth?

Let us consider some of the reasons why it is of importance to do so.

First, there is the matter of personal appearance. The human form has ever been a theme for painters, sculptors and poets. All persons are affected by personal beauty. One has only to think of the consideration bestowed upon a beautiful woman to realize this.

Can a woman with bad teeth be beautiful? The influence of personal appearance in business life also is of just as great importance. Obtaining a position in the business world depends much upon personal appearance, especially facial expression. In this the mouth plays an important part.

Good teeth, white and regular, help much in facial expression. Teeth that are discolored or decayed not only are repulsive, but create the impression that their owner is not a person of good or cleanly habits, and that his early training has been neglected. What is more disagreeable or more apt to create an unfavorable impression than an offensive odor from the breath of another person? A bad breath does not come always from decayed teeth. There are many other things that cause it. But it frequently does come from such a cause or from a coated tongue or an unclean mouth.

Furthermore, the teeth are an important factor in the maintenance of health, and bad teeth give the impression of physical weakness. Business men do not care to employ those who are sickly, or who are liable to become ill.

The loss of one or more of the front teeth interferes with proper speaking. Clear and distinct speech, important and useful in all relations of life, is more than ever necessary in the business world where much business is done by the telephone rather than by mail. Mumbling is always an annoyance, especially in calling of stations on trains. Dictation to a stenographer, of letters that are not always read by the writer, calls for clear speaking. Could anything be of more importance to teachers, or to those who make public addresses?

The mouth plays an important part in the digestion of food. At various times writers have endeavored

to show the necessity of slow and thorough mastication of food; Mr. Gladstone and Mr. Fletcher are often quoted on the subject. Undoubtedly there is much truth in their statements.

The breaking up of the food by chewing, the softening effect of the saliva on food, and the taste and flavor thus called forth, are all important. Saliva contains a substance that brings about a chemical change in certain kinds of food, which takes part in the process of digestion, and prepares the food for absorption. Food hastily swallowed in indigestible chunks frequently produces a lump-like feeling in the throat. The effect of lack of chewing carried to the extreme is illustrated by the convulsions which may occur in infants after swallowing a piece of meat, apple, fruit skin, or other food of like character.

Food can be properly chewed only if the teeth are in a healthy condition. One eminent medical authority has stated that decayed teeth are even more harmful than alcohol.

Those who study in laboratories have in recent years found in people's mouths many different kinds of bacteria. In a book which I have before me, the author describes forty-eight different kinds he has found in the mouth; others have found still more. Among these germs are some which are the cause of various contagious diseases; many of these make the mouth their home and there raise their large families. So large are these families that we may find in an unclean mouth millions and millions of bacteria. Just think what this means when one coughs and sneezes, or in talking sends out a spray. How instinctively we draw back from a person who sneezes without covering the face with a

handkerchief. Yet we constantly come into contact with such people and such actions.

Did you ever see a picture of a surgical operation in a modern hospital, with the doctors and nurses, their heads all tied up in gauze? They wear gauze over the mouth and nose so that no secretions from either can get into the air and fall into the wound. And there is no chance for the surgically clean hands of the doctor to reach his mouth or nose and get germs upon them, even if his nose itches. There can be no talking; only an occasional order and that in a single word if possible, so that no spray can get beyond the gauze mask. There is no lecture to students during an operation, as was formerly the case, but only after the wound has been closed or the patient has been removed from the operating room.

Many varieties of germs, as I have said, are found in the mouth. Some occur only there; these are associated with or are the cause of decay of the teeth. Still others are associated with diseases in other parts of the body. In pyorrhœa, a disease which loosens the teeth and is accompanied by an exudation of pus from the sockets, millions of microbes are found in the mouth.

If the mouth has not been cleansed before a meal, then bacteria mingle with the food in the process of chewing and are swallowed. If there is not sufficient gastric juice to kill them, they pass out of the stomach into the intestines. Here poisonous products of decomposition are produced, which may be absorbed, and give rise to a condition that is known as intestinal poisoning or toxæmia. Such poisons produce fatigue; that is, they make us tire easily; they also lower resistance to disease. Food in the intestines thus undergoes decom-

position by bacteria, and cannot be used by the body for nourishment or growth in the manner in which it was intended.

In the early part of the last century there lived near Detroit a Dr. Beaumont, to whom was brought a patient named Alexis St. Martin. This man had been accidentally shot with a charge of buckshot, which carried away a portion of the abdominal wall and part of the stomach. The wound healed, but left an opening into the stomach, through which the doctor could watch the digestion of the food. He would give St. Martin various kinds of food and note those which digested most easily.

Dr. Beaumont kept St. Martin with him for several years and made many experiments, the results of which he published in a book. From this book physicians have derived much of their knowledge of the functions of the stomach and of the digestion of food, during health and sickness, and under the influence of different conditions. The doctor found that he could obtain gastric juice from the man's stomach and experiment with it. Thus he noticed that pure gastric juice would keep indefinitely, but that if the patient swallowed much saliva it quickly spoiled. This result, with our present knowledge of the millions of bacteria in the saliva, we can readily understand, although it was not fully appreciated at the time the observation was made, for in his day bacteria had not been studied.

A thought that comes to us in this connection is the importance of cleaning the teeth and mouth before meals as well as after. Some people are very careful, especially with children, that the water they drink be boiled, the milk scalded or pasteurized, and food generally well cooked in order to destroy bacteria. If

food be carefully selected and properly prepared, danger from that source is to some extent reduced. But all this care may be insufficient, if the food become contaminated in the mouth, perhaps not only by many bacteria, but by many different kinds of bacteria. Such precautions, then, as sterilizing the food must be supplemented by brushing of teeth and cleansing and disinfection of the mouth before each meal, as well as cleansing after meals to get rid of particles of food.

The teeth may affect a surgical operation. In the past the great dangers of the surgical operation have been from bleeding, or from shock, or from the entrance of bacteria into wounds and consequent blood poisoning, or of pneumonia occurring after the operation. With improved instruments, a greater knowledge of how the body works, newly discovered means of stopping pain, newer combinations of chemicals to kill bacteria, and by better nursing care of the patients, the first three of these dangers have been largely done away with, especially since operations are now done largely in hospitals. But pneumonia still persists. A published report of a recent investigation of the subject calls attention to coughs and colds before the operation, and to exposure before or at the time of the operation. And it also mentions the germs most frequently found in these cases as those growing in the mouth and throat, and upon the tonsils. We know that under the influence of ether some of the saliva may be drawn into the openings leading to the lungs. It would appear then that it is very important that the teeth be in good condition and the mouth and throat be cleansed before taking ether for an operation.

In the world-wide epidemic of 1918, comparatively few people died from the influenza alone, but

hundreds of thousands died from pneumonia complicating it. Pneumonia, or inflammation of the lungs, is caused by different types of pneumonia bacteria; the types that caused death in most of the cases are those most frequently found in the mouth. Would so many deaths have occurred had the mouths been kept scrupulously clean? I feel reasonably certain they would not. In the army the soldiers were given toothbrushes, but many used them for cleaning the welts of their shoes and not their teeth.

Tonsilitis or sore throat is a common illness among both children and grown people in this country, and is a dangerous infection. How do we get them? I am certain that sometimes they come from the bacteria that inhabit the mouth, especially where there are decayed teeth and the mouth is not kept clean. For instance, many times a person gets too tired and snores in his sleep, and the bacteria-laden saliva goes back in the throat, moving backward and forward with each breath over the tonsils and soft palate, and sometimes causes not only a surface infection but gets into the crypts of the tonsils and through the tonsils affects the whole system. The tonsils may also be affected through the lymph channels.

By far the greatest harm that can come from a decayed tooth is that an abscess may form at the root, especially if the tooth is dead. The bacteria in the abscess may enter the blood or lymph vessels, and find lodgment in some distant part of the body. A local infection of this kind is called focal infection. Focal infection of the roots of the teeth is a matter that is daily growing in importance in the minds of physicians, particularly since it has been found that the presence of abscesses is revealed by X-ray photo-

graphs, and since laboratory experiments have shown the connection between such abscesses and the infection of other organs perhaps far removed. Focal infection is often the cause of general disease of the system, and while it may occur in other places in the body, by far the most frequent locations are the mouth and the throat—the teeth and tonsils.

Some diseases, the origin of which for many years has been quite obscure, are now known to arise from focal infections of this nature. For instance, it has definitely been proved that acute rheumatic fever; various forms of neuritis; anæmia; that form of joint disease that permanently deforms and cripples, called arthritis deformans; tuberculosis; various forms of disease, either of the valves or the muscles of the heart; inflammation of the gall bladder; ulceration of the stomach; Bright's disease, and many other diseases too numerous to mention here, may arise from some diseased conditions of the mouth and teeth. It has even been stated that many cases of insanity result from this cause.

It has been shown that certain germs have an especial affinity for certain parts. For instance, germs have been taken from the tonsils of persons suffering from some of the diseases mentioned above, and cultivated. Cultures of germs grown from the pus from a tonsil have been injected into rabbits, producing a disease in the rabbit similar to that of the patient from whom the pus was taken. Many of the diseases mentioned above have been produced experimentally in this way. Furthermore, the removal of the point of infection, such as the tonsils or the teeth, if done with sufficient promptness has cured the case. There can be no doubt, then, that the tonsils or abscesses at the roots

of the teeth or other points of infection, are often the port of entry of dangerous germs that produce serious bodily ailment.

Even though not the primary cause of an illness, focal infections may intensify or prolong it. So it has been shown that colds, headaches, skin troubles and boils are greatly increased by such infections. Fortunately abscesses of the teeth can be diagnosed with greater certainty since the X-ray came into general use in dental practice.

The bones of each side of the face, in which are situated the upper teeth, are hollow. These hollow places are called the maxillary sinuses or antra, each sinus being called an antrum. As the roots of some of the teeth go to the floor of the antrum, an abscess of the root of one or more of them may break through into it. From the antrum inflammation may spread to all of the other cavities in the bones of the face, may seriously affect the sight of one or both eyes, and may even reach the ear. A bad tooth, not properly cared for, may thus form the starting point of an extensive inflammation of the adjoining parts, the cure of which may necessitate many operations.

You ask, how do these germs get into the mouth? Some in the way I have just described, by giving forth spray in talking or sneezing; some from the dust in the street, from dry expectorated material, or from manure from the horses; but germs are probably just as often carried by the hand of the person infected, which constantly touches some germ-laden object, such as a door knob, money, a water-closet seat, or somebody's hand, and then is carried to the mouth.

How then, may we avoid diseased conditions of the teeth and mouth? Only by daily care of the mouth

and by observing general hygienic measures to maintain a high resistance in the body to germ growth, and at regular intervals employing the services of a competent doctor of dental surgery to watch for the beginnings of disease.

Chapter XVII

THE CARE OF THE EAR, NOSE, MOUTH AND THROAT

The parts of the body with which this chapter deals have to do with the sense of smell, taste, and hearing, as well as with breathing, swallowing, and the voice; all of which are so important to our daily work, our happiness, and some even to our life. Although the parts concerned in these functions differ in structure, and have various uses, they are all considered in one chapter because they are related to one another in such a way that if one part becomes diseased, one or all of the others may be affected.

Let us first consider the ear, the organ of hearing. It has three parts, an external, a middle, and an internal ear. It is unnecessary to describe the internal ear, which is encased in bone, as the local care of it is solely a matter for a physician—an ear specialist. It is well to know, however, that this part has to do with the equilibrium or balance of the body; that is, if certain parts of the internal ear are irritated or stimulated, one is affected with dizziness or vertigo. It may be thus irritated mechanically, from rotating the body, that is, turning around fast, or from the movements of a vessel, such as pitching up and down or rolling from side to side, or chemically, as by toxins absorbed from the bowels.

The external part, commonly known as the ear, is called by physicians the pinna or auricle. It catches

waves of sound and conducts them into an external opening or canal. This opening, which ends in a membrane or drum, is about one inch in length and is lined with skin. At the outer end of the external canal are many hairs, while further in are numerous little glands that secrete a wax called *cerumen*. The wax and the hairs are for the protection of the drum. Beyond the drum is the middle ear, which consists of a cavity containing three little bones. This cavity is connected with the upper part of the throat, just back of the nose, by means of a tube. The tube is lined with mucous membrane continuous with that of the nose and throat; so the throat communicates directly with the inside of the middle ear, and disease of the nose or throat may extend through the tube to the ear. Deafness generally has its beginning in such disease; so that ailments of these parts may be very serious and require the immediate care of a physician.

At the same time the outer opening requires care. The wax may become hard, and thus produce deafness until removed. To remove the wax, it should first be softened with a little sweet oil, and then the opening of the ear syringed with warm water and soap. Generally speaking, this should be done by a physician, particularly as extreme dizziness may occur during the washing, and both the patient and the one who does the washing may thus become much frightened. As a rule, home washing usually fails to remove the wax. Sometimes trouble may arise from the presence in the ear of foreign bodies, such as buttons, beads, and beans or other seeds. This occurs particularly in children. Occasionally an insect, such as a tick, may get into the ear, more especially among prospectors, engineers, and those who camp outdoors and sleep on

the ground. To remove such an insect it is best to drown it with oil, and then syringe it out with warm, soapy water.

Sometimes the drum of the ear is injured by diving; or by the shock of an explosion, such as the discharge of a cannon; and occasionally the membrane is ruptured by a blow. Those exposed to danger from any of these sources may protect the membrane by putting a little cotton in the passage. In an industry, such as nail-making, where there is constantly a great noise, considerable relief is experienced when the ear is protected in this manner. In diving it is well to dip the cotton first in oil.

Sometimes, when one feels the sensation of itching in the ear, one is apt to use a toothpick, match, knitting needle, hairpin or some other pointed instrument with which to scratch. This is a bad and dangerous practice. The itching may be produced by several causes, each of which calls for a different remedy. Diseases of the skin may extend to the outer opening. Sometimes a boil may occur there. Buzzing or ringing in the ears is often a symptom of nasal catarrh. It occurs also from taking certain drugs, such as quinine or salicylic acid. Sometimes it is caused by anemia; and it is one of the usual symptoms of shock and loss of blood.

It is not uncommon to see people, principally children, who have discharges from one or both ears. Such a discharge is the result of inflammation of the middle ear, and may be due to various causes: colds, sore throat, influenza, measles, scarlet fever, diphtheria, whooping cough, other infectious diseases, enlarged tonsils, or adenoids. Adenoids are an overgrowth of normal tissue in the throat behind the nose. Fre-

quently inflammation of the ear is the result of the entrance of fluids into the nose and throat when diving. It may also be due to improper use of a nasal douche, to gargling, or more often to blowing the nose improperly.

Handkerchiefs are a serviceable invention, and their use is evidence of good breeding. Properly used, held before the face when sneezing or coughing, as a protection against bacterial infection, or to carry away sputum, and discharges from the nose, they are a great convenience, and may be readily disinfected by boiling and ironing. Especially should handkerchiefs be used in the proper manner when traveling, or mingling with the crowds in a city. Improperly used, they are a great evil, and have undoubtedly caused much deafness and disease of the ear. This is because most people close both nostrils with the handkerchief, and blow hard into it, sending the mucus and the discharges of the nose and throat into the tube leading to the middle ear. One should blow his nose like the countryman or farmer, first one side and then the other, never both sides at once. And never violently.

In the bone behind the external opening of the ear, and connected with the inner portions of it, are a number of cells, which have free intercommunication. These are called the mastoid cells, and when infection or pus reaches them the surrounding bone may become necrosed; that is, it may die. Then the pus may make its way through the bone and thus produce inflammation of the brain. This condition is especially dangerous since a very large blood vessel lies under the mastoid cells; and if the infection reaches this, the blood will clot. The clot then extends down into the jugular vein; and unless there is an immediate opera-

tion for its removal, the person dies. Not only may deafness be caused by infection from the throat or nose through the tube leading to the middle ear, but the tube itself may become obstructed and closed. This tube serves to ventilate the middle ear, so that the pressure of the atmosphere will be the same on both sides of the drum. If there is an obstruction, or if for any reason one tube becomes closed, the air in the middle ear, into which it opens, would then be absorbed, and the person grows deaf in that ear.

To become deaf is a very serious matter, especially if it should happen before the completion of the school education, since education is partly received by hearing. In addition, much of the enjoyment of life is lost through deafness—of music, of song and the radio. From childhood, when the mother hushes the babe to sleep with song, until the last requiem is sung over the grave, song and music, both in peace and in war, play a very important part in the joy of life. How the deaf miss the voices of their friends; to what dangers are they exposed if they cannot hear a noise of warning, especially in these days of motor cars! Even more important is the difficulty experienced in the transaction of business. But most serious of all is the fact that inflammation of the middle ear often threatens life itself. From this fact, and the fact that it is such a delicate organ, anyone having disease of the middle ear should at once consult an ear specialist, rather than attempt self-treatment.

Let us consider another of the facial organs. The human nose varies much in shape in different races and individuals. Some noses are short, some long, some broad, some thin, some aquiline and others pug.

The nose is made up of bone and cartilage; and as

the shape and size depend mainly on the cartilage, it is possible in many cases for a surgeon to change the shape of the organ should it be desired. On the outside are muscles and skin, while the inside is lined with mucous membrane. The bones that make the floor of the interior of the nose form also the roof of the mouth. A partition in the middle, called a septum, divides it into two cavities. This partition makes the inner wall of each nasal cavity. On the outer wall of each side of these nasal cavities are three bony ridges, made by the projecting turbinate bones, each of which folds over in the shape of a scroll. The interior of the nose is well supplied with nerves and blood vessels, as we all know by the pain and profuse bleeding which occur in case of an accident. Opening into the interior of the nose are cavities called accessory sinuses. These cavities or hollow places are found in some of the bones of the skull, that surround the brain, and also in bones of the face. It is believed that these cavities serve to produce lightness, to obtain increased resonance of the voice, and to moisten and warm the air before it reaches the throat. In the forehead, just over the eyes, are two fairly large cavities, called frontal sinuses. Between these, in the upper part of the nose, are cells like those of a honeycomb called ethmoid cells. Behind these are still larger cells, called the sphenoidal sinuses. And on either side of the nose, in the large bones of the face in which are situated the upper teeth, are the maxillary sinuses, or antra. These have been referred to in connection with abscesses of the teeth. All of the accessory sinuses open into the nose through small openings, and are lined with mucous membrane, continuous with that of the nasal cavity. With a cold in the head one or all of the accessory

sinuses may become inflamed. This is the reason why we sometimes have a headache or face ache with a cold.

The nose serves several purposes. It, and not the mouth, is the organ for breathing, since it filters out the dust and germs in the air that otherwise might get into the lungs. Some of this dust is prevented from invading the nose by hairs within the entrance; but most of it is caught upon the mucous membrane covering the scroll-like turbinate bones on the internal walls of the cavity, particularly the middle bone. The nose and its adjoining cavities also warm and moisten the air, and kill a certain number of the bacteria taken in when we breathe.

The nose contains the nerves of smell; this is a sense of great importance to us, on account of the pleasure we obtain from the perfume of fruits, flowers, spices, and the many other delightful odors that nature gives to us. It helps us to avoid putrid materials and dangerous gases. It is also an aid to digestion; for the odor of a savory dish will cause the saliva and gastric juice to flow.

The nose also affects the sound of one's voice. When it is stopped up, it is common to say that a person talks through his nose. As a matter of fact the opposite is true, and removing an obstruction in the nose may help change the voice. If the obstruction affects the tube leading to the ear it may also injure the hearing.

We shall now consider the mechanism of the mouth. Looking into the mouth one sees the tongue, with the teeth in front and on either side, and the roof above. Underneath the tongue are numerous little openings. Two more are located on the inner sides of the cheeks. These openings come from the six glands that produce the saliva, three glands being on each side. Through

these saliva comes into the mouth. Behind the tongue is an arch, in the center of which hangs the uvula, a part of the soft palate. Behind the arch is the entrance to the throat or pharynx. In the lower part of the throat is the larynx, which contains the vocal chords; this can be seen only with a small mirror. On either side of the root of the tongue are two rounded oblong bodies, known as the tonsils. There are other tonsils, but they are out of sight and familiar only to physicians. Above and behind the tonsils, on either side of the throat, are the tubes that lead into the middle ears, and between these, the openings into the back part of the interior of the nose. The tonsils are connected with a chain of lymphatic vessels which belong to the lymphatic system. The lymphatic vessels are closely related to blood vessels, but have in their course a number of nodes or filters. The fluid that passes through these vessels is like blood, but contains no red corpuscles.

A tonsil is not simply a rounded body, as it appears to the sight, but is made up of folds, lying one over another separated by crypts or openings into which particles of food may get. Frequently we find bacteria in the crypts, and these bacteria, acting on the food, produce toxins which erode the outside covering or epithelium of the tonsil. This then becomes infected and the toxins are absorbed into the system.

The mouth, teeth and tongue have several important uses besides that of speech; among others, chewing food, tasting it, mixing it with saliva, and swallowing it. Briefly, besides talking, the purpose of the mouth is to prepare food for the stomach. It is not intended for breathing purposes; since it is the nose that prepares the air for the lungs. The mouth, tongue, nose,

air sinuses and throat are all covered with mucous membrane.

Our first defence, and greatest protection that the body has against bacterial disease, is a whole skin and mucous membrane. These cover the body outside and in, and are continuous one with the other. In many respects they are much alike. As the skin protects the outside, so the mucous membrane protects the inside; that is, the nose, mouth, throat, windpipe (trachea), bronchial tubes, stomach and intestines. The skin is made up of two parts—an outer layer or epidermis, and a deeper layer containing sweat and oil glands, blood and lymph vessels, and nerves. The mucous membrane also has two layers. The one on the outside is a layer of cells, called epithelium, the form of which varies a little in different places. The deeper layer contains glands that secrete mucus, or other special secretions or juices. It contains also blood and lymph vessels, and nerves. The glands are little tubes that dip down from the surface of the mucous membrane, and are lined by epithelial cells of special character.

Germs of disease constantly get on the outside of the body, especially upon our hands, but because of the protection of the skin, we do not contract disease. If, however, the skin is scratched, or rubbed off, germs of disease may enter and obtain a foothold. All of us who have been vaccinated, know that to vaccinate successfully it is necessary to introduce the virus under the skin, or to scratch off the epidermis and put the virus on the raw surface. It is only when the covering is destroyed that infection occurs. So long as the skin or mucous membrane is whole we are not affected.

It is evident, from the great number of people who

suffer from colds and infectious diseases of the nose and throat, that very many do not succeed in keeping the mucous membrane whole. The people of this entire country are especially subject to such diseases, which are the most common ailments to be found here. "Colds" affect this nation probably more than any other, and as stoppage of the nose modifies the voice, perhaps much of the Yankee twang may be accounted for in this way. Some of it, however, is due to laziness in not sufficiently opening the mouth in talking, and to bad habits of enunciation.

The care of the mouth, nose, throat, and facial sinuses means more than the care of the mucous membranes. It includes the care of tongue, tonsils, and voice. It means the prevention of a coated tongue, of sore throat, colds, catarrh, adenoids, tonsilitis, and bad breath. It is not strange, but rather quite natural, that our commonest ailments should come through the nose and throat when we consider our continuous use of these parts, and the little consideration or care we give to them unless we become ill. More than that, not only do we give them little care, but we constantly put them to wrong use, or over-use.

As already stated, the nose prepares the air for the lungs, and the mouth prepares the food for the stomach; but many people breathe through the mouth. This causes dryness of the throat, and such dryness of the mucous membrane leads often to fissures or cracks; or to plugging of the mucous glands. It is thus one of the causes of sore throat. It is also a cause of coughing; for if one breathes through the mouth, he loses something of the warming, moistening, and filtering functions of the nose. One of the first rules of health is to keep your mouth closed when you are

breathing, as well as when you are angry. If you cannot keep it closed it is well to consult a physician.

The mouth has many things to take care of. Think of what we eat, and how we eat it; of the varying temperatures of foods, some hot, others cold, especially in the case of drinks! Or take again the sauces, spices, vinegar, and alcohol we use, and the irritation of tobacco smoke and nicotine. How often food is retained between the teeth, and remains in the mouth after a meal to spoil from the bacteria there! As for the voice, many talk too loud and too long, thus producing a great strain upon the mucous membrane and vocal chords.

As we have said, the outside covering, the epithelium, is an efficient barrier against disease germs unless it be injured; but this injury need only be very slight to allow germs to gain an entrance. It may be due to the destructive action of the products formed by the bacteria themselves, the toxins. This is very important, for it is probably in this way that many sore throats and colds commence.

Let us, for example, consider diphtheria. If enough diphtheria germs of sufficient virulence find the slightest foothold upon the mucous membrane of the nose or throat, they manufacture a toxin that is destructive to the tissues beneath. Surrounding the point of infection, an exudate forms, beneath which bacteria work and the toxins are absorbed, and very serious effects upon the nervous system, even paralysis, are thus produced.

In children who have a cold in the nose, how often the acrid discharge makes an abrasion on the upper lip, taking off the outer layer of the skin, and affecting also the skin on the end of the nose. True, the abrasion may be due partly to frequent wiping with a handkerchief,

but it results chiefly from the discharge. Those who have cared for babies can well understand this; and will realize how often the discharges from the body are destructive. If, for instance, a diaper wet with urine or with the discharge from the bowels, especially in cases of summer diarrhœa, is not changed within a short time, the skin becomes red and appears scalded.

Chapter XVIII

THE CARE OF THE EAR, NOSE, MOUTH AND THROAT—Continued

Some people have the power to resist the invasion of germs of disease. This power is called immunity. There are several ways in which immunity against disease may be obtained. Certain races and certain families have natural immunity against certain diseases. A person may be exposed to contagious disease, and not get it, that is, under ordinary circumstances. But some persons naturally resistant to a certain disease, may take it under peculiar circumstances, since the degree of continuance of immunity depends on many things.

Other people may acquire immunity or resistance. That is, they may have an attack of infectious disease, get well, and thereafter resist the disease. Acquired immunity is due to some changes that take place in the body, after having such a disease. After attacks of certain diseases, such as smallpox, scarlet fever, or typhus fever, resistance or immunity may last a lifetime. From some other diseases it may last only a short time.

Dead bacteria, or their products, that is, a vaccine, may be injected into persons and thus make them develop their own immunity. This is active immunity. In promoting this method of acquiring immunity from disease, much has been done, especially by the New York City Department of Health. Those who oppose

vaccination for smallpox, diphtheria, and other disease, are simply ignorant.

Resistance may also be obtained in another manner; namely, by introducing the serum of an immune animal into a person who is not immune. This is called passive immunity. The serum must be injected into the body, as under the skin, or into the circulation, in order to become effective; swallowing the serum will not suffice.

What is serum? If one opens a blood vessel of an animal, and catches the blood in a basin, after a little while it separates into parts, a red clot, and a somewhat yellowish fluid called serum. Let us suppose that we draw some blood from a healthy horse, obtain the serum, and then with a hypodermic syringe inject a small amount of this horse serum into a guinea pig. The guinea pig does not seem to mind it especially, and continues to eat and behave in the usual manner. But if, after a period of eight or ten days, a second injection is given, a little larger than the first, the animal becomes restless, scratches its nose, becomes short of breath and dies. By the first injection it became sensitized. This is called anaphalaxis, the opposite of immunity.

We have but little if any positive proof that human beings may in this manner become what is called hypersensitive. On this matter there is some difference of opinion, but we do know that some people are hypersensitive to certain things by inheritance. There are certain foods, drugs, and serums, which under ordinary circumstances most people can take with impunity, but which may be very poisonous to certain individuals. Some people are sensitive to strawberries, to quinine, or to other foods and drugs. Some are sensitive to the pollen of certain plants; while to some diphtheria anti-

toxin, is extremely dangerous, though fortunately these are very few. Some people are extremely sensitive to the sting of a bee or a yellow jacket. This sensitiveness to certain things is called allergy.

Among the persons thus sensitized are those who suffer from what is commonly known as hay fever, "rose cold," or autumnal catarrh. The symptoms are like those of an ordinary cold, or coryza, but there is generally more frequent sneezing and perhaps more headache. It has been shown that the nasal mucous membrane of such people is sensitized to the pollen of one of a number of plants. For this form of "cold" much can be done. It is of especial benefit to have a change of climate.

There are those who will occasionally, at some time in the day, have a coryza, or discharge from the nose and the eyes, lasting sometimes only a few minutes, sometimes half an hour, or even longer, and necessitating the use of several handkerchiefs. Commonly this happens in the morning before the bowels have moved, after which the "cold" disappears. In these cases something has disturbed the nerves that control the caliber of the blood vessels in the nose, causing a temporary paralysis of the contractile walls of the smaller blood vessels. This disturbance may arise from something eaten, to which perhaps one is hypersensitive. Or it may arise through the absorption of some toxin formed in the bowels, which for some reason, probably want of exercise, has passed the quarantine of the liver. Poisons absorbed from the intestine through a vein, called the portal vein, reach the liver, and are there generally destroyed.

Many physicians believe that acidosis,* even if slight,

*See Chapter on Getting Tired, page 88.

lessens resistance to infectious disease and predisposes to or accompanies a cold.

It is now fairly well established that ordinary colds result from some form of infection of the mucous membrane of the nose and throat. We realize this by observing that when one member of a family has a cold, others often contract it. As regards the frequency with which any particular part may be affected, more than half are "colds in the head," that is, affections of the nasal cavity and accessory sinuses. Infection of the tonsils come next. The kind of germ that produces a cold, however, is not always the same. Probably several forms of bacteria may attack the mucous membrane and produce almost identical symptoms, and as a general rule the same kind of germs attack the same person. Inasmuch as the germs that cause colds are ever prevalent in a large city, it seems to be impossible to avoid infection; many people with colds go daily to work, or out shopping, and we meet them in cars and in crowded assemblages. From their sneezing, coughing and talking, the microbes enter the mouths and noses of others, or are transferred by means of the lips in kissing, by pencils, handkerchiefs, or by the hands. Our hope, then, of avoiding such infection lies in the education of the public regarding the common methods of conveying infection, and in awakening in the people at large a sense of their duty in such matters. Our resistance to disease should also be kept up or raised, chiefly by the care we give our bodies.

The direct cause of a cold, then, is infection; but there are other causes that are predisposing. To prevent colds, we should avoid the causes that lead to them; that is, the predisposing causes. Or, as this is not entirely practicable, we should take as soon as possible

such precautions as will enable us to overcome the effect of the conditions or circumstances which may injure us or affect us adversely. What are these predisposing causes? Hippocrates, who lived 400 years before Christ, attributed winter diseases to cold and changing temperature. Since his time, with both physicians and people generally, this cause has stood first. Cold and changes of temperature affect our skin, and thus the nervous system that supplies the skin and the vessels within and beneath it. Through the nervous system they affect the whole body.

So we have a direct local effect of colds, and also an indirect or constitutional effect. We have all experienced the local effect of cold. If a part is exposed on a cold day it becomes pale and chilled, with the appearance of gooseflesh, and benumbed; afterwards it gets red, swollen and tender. The blood vessels at first are contracted and diminished in size, and afterwards more open and enlarged. The deeper tissues sympathize through the nervous system, the heart beats faster, and if one has a weak organ, it is apt to suffer from internal congestion.

The common causes that produce these effects are insufficient clothing, especially on cold windy days, particularly when sitting still as during prolonged driving. Sitting in a draft, or on damp ground when on a picnic; sleeping with insufficient covering which so often happens when one takes a nap—or in clothes moist with perspiration; living in damp houses; sleeping in cold beds; exercising too violently when heavily clad and after cooling without changing one's clothes; wearing wet clothes, or having wet feet—all these things may prove injurious to us, although they may instead but serve to harden us. We may become accustomed to

many curious fashions. Women are in the habit of wearing short sleeves, or none at all, and dresses open above the waist, back and in front; short skirts, and thin shoes and stockings. They may sit for hours dressed in this manner without apparent injury; but if a man accustomed to heavy clothing were to do the same, he would undoubtedly suffer a penalty.

That cold may operate in any of the ways enumerated above we have learned by experience, but we also have scientific proof that cold reduces resistance. Pasteur found that a chicken had marked immunity to anthrax, but that this immunity could be overcome by lowering the body temperature from putting the chicken in cold water. Experiments have also been made as to the effects of keeping a squirrel moving in a cage until greatly tired. It was found that the squirrel's resistance was thus lowered. Therefore cold and fatigue increase our liability to infection. Especially is cold injurious to children, whose stock of animal heat is small.

We feel the cold more in some climates than others, and more where there is much fog and dampness. This can readily be explained if we understand the channels by which heat is lost. It has been calculated by one investigator (Vierodt) that we lose by

Urine and feces	1.8 per cent.
Warming expired air	3.5 " "
Evaporation of water from lungs	7.2 " "
Evaporation of water from skin	14.5 " "
Radiation and conduction from the skin	73.0 " "

In a hot, dry climate the dry, warm air cools us by carrying away rapidly the water from the skin by evaporation. In a cold climate, cold moist air carries away heat by conduction, which, as we have seen, is the

principal means of losing heat. So it is easy to catch cold in New York because of its situation on rivers, bay and ocean, thus giving it a very damp atmosphere.

Fatigue is one of the predisposing causes to colds. Not only may we be tired from work, either physical or mental, in the various ways already explained, but we may also tire from exposure to cold. For cold may tire our heat-making apparatus by making it work faster. It may also tire us by the annoyance we suffer if we sit in a draft or have cold feet. Such things are fatiguing in the same manner as fret and worry. So sudden changes continued for any considerable length of time are to be avoided. The skin must always be comfortable.

Exposure, then, to cold, either of the whole or a part of the body, may help to produce disease, and it has always been considered as a most prolific cause of disease.

The effect of cold, however, may be quite different under varying conditions of the system. In fatigue the nervous system does not react quickly, and the effects of cold are felt to a greater extent. If we are hungry and have not had sufficient food or drink, or if the stomach and bowels are disordered and there is any absorption of toxins, the effect is more noticeable. These things, then, are added causes. If we lack sleep and have stayed up all night for amusement or for the care of a sick person, how chilly we feel in the morning. Then we are apt to become a prey to disease. How often has a wife and mother, either through nursing her husband or a sick child through an attack of pneumonia, become ill herself and died from the disease because of lowered resistance from fatigue, worry, want of sleep, and of proper food and drink.

Some professional men, notably clergymen, suffer much from sore throat and cold because of their sedentary life, over-use of the voice, and inability through lack of money to care properly for themselves. Other causes are crowded rooms, a lack of fresh air, rooms that are too hot, an indoor life, over-eating, constipation, a bacteria-laden mouth with decayed teeth, or debility from chronic disease. These, then, are the things to avoid. Can we avoid them? Not entirely!

How often in the past has the country doctor been called upon, after a hard day's work with many visits, to harness his horse and drive a distance—occasionally getting out of the buggy to tramp down snow-drifts for the horse—to a confinement case which necessitated the use of instruments, to work alone, assume all responsibility, with the worry which is entailed by a human life in danger, to go without sleep, get overheated in the sick room, and drive home with wet feet and moist clothes, thoroughly chilled, tired and hungry. And not merely once, but many, many times. Yet how rarely does he suffer any ill effects! For when the horse has been put away and given some hay, the worry passes and an intense satisfaction in the work accomplished takes its place. Perhaps only a physician knows what this means. Then he removes his wet clothing, washes his feet in cold water, brushes his teeth, gargles his throat, takes a long, warm drink of hot milk, tea, coffee, or broth, perhaps eats a little and sits by the fire for a while thinking over his cases and planning his work for the next day. At last becoming sleepy, he goes to rest, to find himself on waking free from danger of illness, thoroughly recuperated and ready for another day.

The tired worker, whether business man, housewife

or worker in any walk of life, should first try to forget work, and then do the things mentioned. Perhaps, in addition, if one lives in a city and must travel on trains or surface cars he should use a nasal douche to rid his nose of dust and bacteria, remembering to incline the head forward and to one side over a basin, and never to blow the nose hard, or on both sides at once.

It is of especial importance that those who work in mines or mills at continuous hard labor should remove wet clothing as soon as possible after ceasing work, have a shower bath to relieve fatigue, and then put on dry clothes. It is customary now at most mines to have change-houses with lockers and baths for such purposes. If the worker rides home in a trolley in damp, dirty, bad-smelling clothing, he is apt to lose not only resistance to disease, but his own self-respect and the respect of others.

So we may by means of warm drinks, sleep, food, evacuating the bowels, changing clothes, local treatment of the mouth, nose and throat, avoid a cold, or cut it short when it has commenced. The warm drink helps to equalize the temperature of the body, and to increase the secretion of the skin and mucous membrane, to throw off surface waste, dirt and infection.

Our pleasures are probably more dangerous than our labors. Fishing, golf, long walks, to which we are not accustomed, commuters' Saturday digging of gardens, Sunday excursions, especially on crowded trains, or the supper and dance after the theatre, all involve risks. Many are not satisfied with ordinary pleasures, but go always to extremes. The late dance when one is lightly clad, the breathing in of dust, lack of sleep, and eating too many sweets are dangerous.

We are apt to look lightly upon a cold. This is a

mistake, for pneumonia often follows; and especially does resistance to pneumonia germs seem to be lost by the patient after or during an attack of influenza. For those who are subject to colds, much may be done to harden the body, so that the skin is made less sensitive. Bathing comes first—the daily cool shower, or sponging the body with cold water, and in the summer, sea bathing. One should get accustomed also to the cold plunge and the brisk rub. Next, one should take care to wear sensible clothing, night as well as day, to take an occasional sun bath, breathe fresh air, and to sleep with the window open.

Especially should one be treated for any focal infection, and deflections of the septum, deformities, or swellings of the nose should be treated. If adenoids are present they should be removed. Though tonsils have their use in the body, they are dangerous if diseased. Frequently they may be cured without removal. They help to protect the body against microbes, but they often become diseased. Sometimes this comes from the teeth. Frequently it is caused by milk from a cow with disease of the udder; and epidemics of sore throat have occurred from this cause. Sometimes in this way tuberculosis of the glands of the neck will result.

There are some persons who drink milk at the end of a meal, or drink it just before going to bed at night; many children live on it. If a film of milk is allowed to remain over the mouth, tongue and tonsils, it is rapidly attacked by microbes; and this also tends to a sore throat, tonsilitis, a coated tongue, and foul breath. It is a good plan to rinse out the mouth after drinking milk, as well as to brush the teeth after meals.

Since tonsils have their use as a part of the body, when shall they be removed? The human body works best as a perfect whole. It is a serious matter to remove any portion of it, whether teeth, tonsils, turbinates, gall bladder, appendix, or ovaries, or even to perform circumcision. The appendix, of course, is of no value, but the operation may be dangerous.

If a part is diseased, and there is danger from this disease to other parts of the body, or if it has lost its usefulness and cannot be restored by any means, then, like a dead limb of a tree, it should be removed, provided there is not too much danger to life in the operation. But if the danger to the body is not immediate, and it is possible to save the part by recognized means of treatment, the attempt should be made. If a part is deformed, the correction of this deformity should receive careful consideration. This may be for appearance sake, or because the body is injured by the deformity.

How may we judge? In these days of X-rays much may be done to avoid indiscriminate operation. For instance, if a tooth having several prongs is dead, and the X-ray reveals the presence of an abscess at the root, have it removed. This removal in some cases is best performed by a method known to doctors of dental surgery as "surgically." That is, instead of pulling the tooth in the ordinary way, procain (novocaine) is injected so the patient will not feel pain, then the gum is cut and the bone on the outer side of the tooth is chiseled away, the tooth turned out and the abscess curetted or scraped. The cavity is then packed with gauze. When there are many teeth and old roots to be removed, this method saves considerable time in preparing the mouth for a plate. It may be possible, how-

ever, for a time, to save without danger a dead tooth by amputation of the root after the root canal has been filled.

If both the teeth and the tonsils seem to be responsible for body infection, remove the bad teeth first, and see if then the tonsil will not get well with proper local treatment. On the other hand, we must remember that infection from the tonsils is often very dangerous. The value of a diseased tonsil is not to be compared with the danger, involved by its retention, of contracting valvular heart disease, rheumatism, or other serious disease of some internal organ. It is not proper in such a book to attempt to give rules for guidance in all cases. Each individual case must be judged by a competent physician—the physician in whom you have most confidence.

Chapter XIX

HOW TO AVOID DISEASE OF THE LUNGS

Statistics show that ordinarily in New York City over twenty-five per cent., that is, one-fourth, of all the deaths that occur during the winter months are the result of some form of lung disease, principally tuberculosis (consumption), lobar pneumonia, broncho pneumonia and bronchitis. All of these are largely unnecessary and preventable.

To know how to avoid these, we must first learn the use of the lungs, and how they are formed.

As already stated, one purpose of the blood is to carry oxygen derived from the air to the tissues, and carbonic acid away from them to the lungs. There the carbonic acid thus taken up is thrown off and replaced by a fresh supply of oxygen. It is therefore necessary for all the blood in the body to be brought in contact with the oxygen in the air; and nature has provided the lungs for that purpose. They are in the chest under the ribs; and communicate with the outside air only in breathing. The air enters the nose (or the mouth), passes through the larynx, and then through the wind pipe (trachea), which divides into two tubes (called bronchi), one for each lung. The bronchi divide and subdivide until they end in small divisions called lobules. There they connect with air spaces when the exchange of gases occurs between the air and the blood.

The larynx contains the vocal cords with which we produce the voice, and shows on the outside in front

of the neck. It is commonly called Adam's apple. Just below this is the windpipe, about four inches in length, composed of a series of rings open at the back and connected by membrane. The inner surface is lined with mucous membrane, and provided abundantly with mucous glands. Forming a part of this membrane, and covering it, are thousands of cells with hair-like projections or processes which have a constant wave-like motion upward toward the mouth. Underneath the mucous membrane lies some muscular tissue, which is not under the control of the mind.

The bronchial tubes, large and small, are made up in much the same way as the windpipe, having rings, muscular tissue, mucous glands and cells with projections having wave-like motion. There are a number of reasons why it is important to know all these structures. For instance, sometimes the muscular tissue will have a spasmodic contraction; this is asthma. Or again, the mucous glands may oversecrete and the mucus is worked up toward the mouth by the wave-like motion of the cell processes. This generally causes a cough, and the mucous secretion or phlegm is coughed up. Sometimes the whole surface of the bronchi becomes inflamed; this is bronchitis.

To understand other lung diseases one must know still more of the structure of the lungs. Each lung is divided into large portions called lobes, the right lung into three, and the left lung into two. These are divided again into lobules, and the final divisions are the little air sacs or, as they are called in medical works, air vesicles. The wall of an air sac is provided with a very thin membrane, and under the membrane is a network of small blood vessels (capillaries). Nothing intervenes between the blood and the air but the

thin walls of the air sacs and of the blood vessels. The air sacs do not connect one with another, so that if a tube leading to one is obstructed, as with mucus, the supply of air to that portion is entirely lost. The outside of the lungs and the inside of the ribs are covered with a membrane, making a closed sac, the inside surfaces of which are moist. As the lungs expand when we take a breath, these surfaces slide one over another. These membranes form the pleura; and inflammation of any portion of their surfaces is called pleurisy.

The lungs are nourished by means of blood vessels, separate from those that bring the blood there to receive oxygen. They are also supplied with lymphatic spaces, vessels and glands.* There are also lymph spaces in the bronchi and in the pleura.

One of the uses or functions of the lymphatic system, and especially of the glands, is to arrest and destroy bacteria. It is, however, a question as to what extent it acts in this capacity. In order to help us avoid disease of the lungs, let us consider some of the more important diseases to which the lungs are subject.

Tuberculosis, or consumption of the lungs, today is world-wide in its distribution. It was well established in the fifth century before Christ. Prior to that time it is known to have existed in another form, for there is recorded the finding of a mummy of the period 1000 B.C., with Potts' disease, that is, tuberculosis of the spine.

Until about fifteen years ago it led all other diseases in the number of its victims. Then it was exceeded by the deaths from pneumonia, and since then these two diseases have about equalled each other in the number of annual deaths. Probably, however, all of the deaths

*See page 214.

from tuberculosis are not recorded as such, for all cases are not as yet reported, and physicians sometimes yield to the wishes of the members of a family who strongly object to entering it as a cause of death upon a certificate. This is on account of the persistent belief that tuberculosis is inherited, because of possible complications in the collection of insurance, and for various other reasons. So the published death rate from tuberculosis is probably below the real rate. For fifty years the number of cases of tuberculosis has been declining; though in the last ten years the decline has been more rapid than before. Those who are familiar with the conditions of fifty years ago can readily understand the reasons for the steady reduction. Nowhere in this country today is there the squalor and misery of fifty years ago. Then there were many who never had sufficient food, and some who literally starved; drunkenness and pauperism were rife; there existed inside tenements with overcrowding, dirty streets, poorly paid labor with long hours, and a much greater number of all infectious diseases. As all these things greatly lessen resistance to disease, it is but little wonder that the general death rate was proportionately more than three times as great as now. The proportion of deaths from tuberculosis was double that of today.

The germ or bacillus that causes tuberculosis was discovered forty years ago, but it took a long time, fully fifteen years, to convince physicians generally that it was the cause, so deeply had the idea of inheritance become rooted in their minds. It was twenty years before any very active campaign was made to lessen the cases of disease of the lungs from this cause. Since then, in the last twenty years, the death rate from

this form of tuberculosis has dropped fifty per cent., which should give much encouragement for further efforts, as it tends to show what can be done. It should be remembered that tuberculosis affects not only the lungs, but may attack any part of the body. The bacillus or germs of tuberculosis may reach the lungs in two ways, directly through the blood vessels and lymphatics to the air cells, or through the bronchi by inhalation. In the air cells the irritation of the germ produces a little gray nodule or tubercle, the size of a millet seed, which is about 1/12 of an inch in length—and only a small portion of the lungs may be involved. Physicians call this miliary tuberculosis. When the bacillus reaches the lungs through the bronchial tubes, the inflammation is marked especially by an inflammation around the tubes.

The germs of tuberculosis are widely scattered and are found wherever human beings crowd together. From a single person hundreds of millions of germs are thrown off every day. So in cities when people expectorate in the streets, on floors, and in conveyances, the material coughed up (the sputum) dries and becomes dust and is distributed far and wide. Every person who goes into the street at some time will inhale the germs, which may find lodgment in the lungs; and in many cases they do lodge there. The results of post mortem, that is, after-death examinations, made in hospitals and other institutions show that nearly all those examined had tuberculosis at some time in their lives, but that in many cases the disease had been arrested or cured. Some say the proportion is as high as 80 per cent., others still higher; and one German investigator has stated that everyone has had the disease at some time in his life. It is also stated by those who

have studied the matter that at any one time at least two per cent. of the population show the presence of active or arrested tuberculosis. This means that of the 6,000,000 persons in New York, 120,000 show its presence.

How do the germs of tuberculosis gain access to the human body? By actual contact with those that have the disease; from touching hands, kissing, talking, coughing, sneezing, breathing dried sputum, using utensils that have been used by a consumptive such as cups or towels, or from flies which have fed upon sputum and pass many millions of germs in fly specks. A well fed fly passes about twenty specks a day; but if it feeds on sputum from tubercular persons it may pass double this number, each speck containing many living germs. Another source of danger is from using infected cows' milk. This cause especially affects children, and the germs may gain access through the tonsils, or by the intestines.

We are protected against these germs in several ways. Much of the dust we breathe is caught upon the mucous membrane of the nose and throat. Lining the windpipe and bronchial tubes are the short hair-like processes that have the upward wave-like motion, constantly propelling dust and germs upward to the mouth. If the germs get into the lungs and pass into the circulation they may be caught by the white blood corpuscles and killed, or they may be filtered out by the lymphatic glands. If swallowed with food, they are usually killed by the gastric juice. If they pass the quarantine of the stomach they are apt to die in the intestines, and if absorbed by the lymphatic system, are likely to be killed in the lymphatic glands. If absorbed into veins they may go through the portal vein into the liver and

die there. Thus, notwithstanding the fact that we come in contact with tuberculosis germs every day, we need not acquire the disease.

We know by experiments and by experience that there are many predisposing causes: lack of nourishing food, proper exercise, sleep and rest, and sunlight; bad teeth; getting overtired; poor ventilation and bad air; injury to the mucous membrane from exposure to dust, gases or fumes; or diseases such as bronchitis.

So the extinction of tuberculosis depends upon an adequate supply of foodstuffs, proper housing and working conditions, cleanliness, sanitary schools and transportation; in fact, upon the condition of our whole economic system.

We cannot avoid contact with the germs of the disease; but we can lessen our chances of infection and raise our resistance to it. There is not much danger of getting tuberculosis if one keeps in perfect health and follows the recommendations of this book. Teaching personal hygiene to young and old is the principal method of fighting tuberculosis, and so every chapter here has indirectly to do with tuberculosis.

One noted investigator believes that the right amount of food has more to do with the cure of tuberculosis than any other one thing, which means, of course, that food has much to do with its prevention. Dr. Trudeau especially brought out the fact that rabbits inoculated with tuberculosis and confined in dark, damp places soon succumbed to the disease; while others, permitted to run at large in the fresh air and sunshine, recovered.

Still another writer says that as exercise aids greatly in keeping up the lymphatic circulation, it helps to protect the body. Other writers lay stress on other things. As a matter of fact, all of the things men-

tioned are of importance, and watchful care in every way is necessary to prevent the disease. Even if one should acquire it, we know that the vast majority recover; also that it may be arrested. In other cases one may live many years with it. The principal thing is the early recognition of the disease.

Consider, secondly, pneumonia. This is an infectious disease. It may be due to different kinds of micro-organisms. Lobar pneumonia is ordinarily due to one variety of germ known as the pneumococcus, of which there are several types. Broncho-pneumonia may also be due to the pneumococcus, but is often due to other kinds of germs—especially the streptococcus.

In what is known as lobar or fibrinous pneumonia, the part of the lung affected becomes solid, like liver. This is an infection of the air sacs, and one or more of the five lobes may be affected. The lobe or lobes affected become useless for the time being. Usually one lobe or one side is affected at one time. If all the lobes become filled at once, the patient must die. Sometimes the disease travels from one lobe to another, one largely clearing before the next solidifies.

In broncho-pneumonia the infection is principally of the finer bronchi. In this variety there is mucus and pus, which affects also the air sacs; more particularly by plugging the small tubes; and in these cases there is generally more than one kind of germ.

The result of the work of the Pneumonia Commission in New York shows that the pneumococcus is present in the mouths of a large number of healthy people, ready to produce disease when the resistance of the individual is lowered. In the winter time perhaps 80 per cent. carry these germs around with them; and in different persons the germs vary in virulence; that

is, in their disease-producing power. The number of cases and the number of deaths vary with the virulence, and this may vary in the same season, growing worse toward spring—and may also vary from season to season. So the disease varies much in different years and seasons.

The mortality rate also varies according to the altitude or elevation of a town; as well as with the occupation of the people. Those who live at a high altitude, and those who continually work in dust, are more apt to die than those who do not. It is not necessary in this book to describe the course of the disease. Cold, fatigue, alcohol, influenza, and many other circumstances and things lessen a person's resistance and so make one more susceptible to the disease.

One should be very careful if called upon to help care for a case, to avoid as far as possible the predisposing causes; to destroy the sputum, to wash the hands, frequently brush the teeth and care for the mouth, eat regularly, avoid catching cold, obtain sufficient sleep, properly ventilate the room, keep the bowels open, and take all other necessary precautions.

Pneumonia frequently develops after surgical operations. We often hear of the operation being a great success, but that the patient died. In many such cases pneumonia is the cause of death. The ether irritates the mucous membrane, and the bacteria from the nose, throat and mouth are drawn into the windpipe. Thus the germs of pneumonia from the mouth may get into the bronchial tubes and lungs. It is important to have the mouth clean and as near as possible free from germs before the administration of ether or any other anæsthetic.

When one talks he sprays the air with saliva, not

only outwardly, but also inwardly, in the larynx, windpipe and bronchial tubes. If the mouth is not clean and the teeth well brushed, the pneumococcus is sprayed upon these parts and reaches the lungs. No doubt most cases of pneumonia are due to this self-infection. So the principal way to avoid pneumonia is to keep the mouth in a clean and healthy state. This does not mean swabbing the mucous membrane with strong antiseptics. Such a procedure often irritates and breaks the membrane, and thus actually increases susceptibility to the germs. Ordinary cleanliness is important, and especially during an attack of influenza. Few die of influenza, but many from pneumonia following it.

Bronchitis is an inflammation of the mucous membrane lining the bronchial tubes. In both acute and chronic forms it depends upon climate, season, and age. It is a very common disease, often following a cold in the head, or a sore throat. The inflammation extends downward through the larynx into the windpipe and tubes. Different kinds of germs may cause this disease, the most frequent being the kinds that cause pneumonia, and cold in the head. As is general in all inflammation, the mucous membrane becomes reddened, congested and swollen, and usually causes a very distressing cough. Since bronchitis generally has its beginning in a neglected cold in the head, the best way to prevent it is to take care of the cold in its beginning. The same things that predispose to pneumonia and consumption, predispose also to bronchitis; and this may lead to pneumonia or consumption.

Another disease of the lungs is due exclusively to dust. Dust is dangerous to all; and as a general rule there is no necessity for anyone working in dust. With

modern appliances it can be removed, and its removal is merely a question of cost—the value placed upon human life.

Of the many other lung affections, but one need be spoken of here, and that is asthma. This is due in some cases to dust, but more often to the pollen of certain plants and flowers, emanations from chickens, cats, dogs or horses or to certain articles of food. To any one of these a person may be sensitized. The kind of food that causes an attack is scientifically determined by the physician who makes a slight opening in the skin, not sufficient to draw blood, and then inoculates the wound with a preparation of the substance suspected. In most cases it is necessary to make thirty or more of these punctures and inoculate each with a different food or other preparation, using the forearm, and doing it all at one sitting. If a person is sensitive to any particular substance, a large slightly raised red spot will show upon the skin surrounding the wound, and will continue red for some time. Even the most common foods, such as flour, beef, potatoes, tomatoes, etc., are poisonous to some persons. It is this condition of extreme sensitization that causes the particular substance to produce the spasmodic contraction of the bronchial tubes that constitutes the asthmatic attack. The cure for asthma of this variety is to avoid the food, pollen, animal emanation or whatever else produces the trouble, or else to de-sensitize the person by appropriate treatment.

Chapter XX

THE CARE OF THE HEART AND BLOOD VESSELS

The purpose or function of the blood is that of a carrier. It has the power of absorbing certain materials, taking these where they are needed, and there giving them up. Thus food that has been digested and absorbed is carried to the tissues for nourishment; oxygen is carried from the lungs; waste products from the tissues; heat to equalize the temperature of the body; secretions from the various glands to regulate body action, as well as other materials which play an important part in warding off disease, and in the production of immunity.

To accomplish these objects the blood circulates through the body in the arteries and veins. It is propelled through these vessels by the contractions of the heart, and circulates throughout the body from the heart, back again to the heart. Thus we have a central pump, a closed system of tubes, and in these tubes an endless circulation of the fluid (blood) contained therein. Because of the things which the blood must do, the heart must ever keep at work. It beats ordinarily seventy to eighty times a minute; never ceasing from before birth until death. Like machinery, if used properly, it becomes better with work, and runs more smoothly. If forced beyond a certain speed, however, it is injured.

The heart is made of muscle, that is, of flesh. It is

hollow, and is divided into four compartments or chambers. In the middle there is a partition, so that there are two chambers on each side. Each half of the heart has a receiving chamber, and a pump which is both a force and a suction pump. Thus there are two which are joined together and work in unison. The upper chamber, on the right side, receives the blood from the veins after it has circulated in the body. From this receiving chamber it passes through a valve into the lower chamber. Thence it is pumped into the lungs, where it gives up, as waste, carbon dioxide and other products of combustion, and also takes up oxygen from the air. From here it passes to the receiving chamber on the left side, and through a valve into the lower compartment. Then it is pumped into the arteries and travels throughout the body, valves preventing it from reversing its course. There are two valves between the chambers of the heart, one on either side. There is also one at the end of each large vessel connected with the pumping chambers. The blood is thus compelled always to move rapidly onward. Much of it makes the entire circuit of the arteries and veins, passing through the body in half a minute. The time necessary, however, for it to make the circuit depends somewhat upon the route taken. It depends also some upon posture, movements of the body, and breathing.

In some people, the heart naturally beats slowly; in others it beats rapidly. Even in healthy people, we find a natural difference, ranging from below sixty to over ninety beats a minute. It takes much force to send the blood through the body, so that there is considerable strain upon the valves. At each heart pump or beat, the blood passes through the arteries in a wave, this being the pulse. By placing the fingers upon an artery

we can count the waves, or heart beats. By placing the ear to the chest, over the heart, we can hear it beat. Each beat has two sounds, like lūb-dūp. A physician, accustomed to the sound of a healthy heart, can recognize some of the disorders of the heart by variations in these sounds; or by other sounds or murmurs that accompany the normal rhythm.

The continuous beating of the heart gives, to some persons, the idea that it never rests; but, as a matter of fact, it rests between the beats. So it works about half of the time, and rests the other half.

The action, or beat, of the heart is controlled by certain nerves, of which there are two kinds. One set makes the heart beat faster, and the other slows it. Most of the muscles in the body are controlled by the will; that is, you wish or will to do something requiring muscular action, and then you put them through the necessary motions: but the heart, although it is composed of muscle, is not under the control of the will. It is, however, much affected by the emotions. Fear and anger in particular greatly increase the rapidity of heart beats.

The heart is enclosed in a membranous bag called the pericardium, the inner side of which secretes a fluid that lubricates the heart as it beats. This prevents friction and permits of easy action. The inside of the heart is lined with a smooth membrane called the endocardium.

After leaving the heart, the blood enters, first, the arteries, which divide and subdivide, lessening in size, down to the smallest, called arterioles. These arterioles connect with still smaller vessels of a different kind, called capillaries, which are smaller than the finest hairs. Nevertheless, blood corpuscles can pass through

them. The capillaries empty into small veins, these in turn into larger ones, and these last return the blood to the heart. There is, however, another set of vessels that aid in its return. These, called lymphatics, have been spoken of in other chapters, and will here be described.

Blood is composed of two parts, a solid consisting of corpuscles, and a liquid known as plasma. When the blood reaches the capillaries, some of this thin liquid part passes through the walls into small irregular spaces between the body cells. From these spaces the body absorbs nourishment, which in its new form is now called lymph. The lymph spaces open into very small thin-walled tubes, the lymph capillaries. When the lymph has finished its work it is collected in these capillaries, which unite with others. Finally, this part of the blood reaches two ducts of different sizes, which empty the lymph from the two sides of the body into large veins, near where these join before entering the heart. At intervals there are what are called lymphatic glands.

In general, arteries are tubes composed of several layers or coats. There is first an inside lining, then an elastic layer, next a muscular coat, and finally, an outside covering. The middle coat, composed of muscle, is the thickest. Naturally, the pumping of the heart causes pressure upon these tubes. A certain resistance is offered by them, and the combination of these two forces constitutes blood pressure. We notice the pressure when an artery is cut, since the blood spurts out. The walls of the arteries are elastic, this elastic tissue and the muscular wall preventing the artery from rupturing. Should the pressure become too great and of too long duration, as in severe daily labor, the walls grow thicker to meet the demand. This thickening is

a compensating arrangement on the part of Nature. She adapts herself to circumstances, thickening the walls of an artery to resist the strain of hard labor; and thinning them when the requirements lessen, as in those whose habits change to sedentary. The heart thus adjusts itself to varying circumstances and conditions. The walls of the veins are thinner than those of the arteries and, in many places, contain valves to prevent the backward flow of the blood.

Both the heart and the blood vessels are supplied with blood for their own nourishment, by means of small vessels within their walls. The arteries are also supplied with nerves. Their muscles, like those of the heart, are not under the control of the will. By means of these nerves the muscular wall may be made to contract, lessening the calibre of the arteries and so producing a higher blood pressure. Or they may expand, and thus reduce this pressure.

To prevent disease of any organ, we must know the diseases to which that part is subject, their cause or causes, and how to prevent or remove them. Disease of the heart may affect the outside covering, the muscle of the heart itself; the membrane that lines it; the valves; the vessels that supply the heart walls with nourishment; or the nerves that affect and control its action. To work perfectly there must be a healthy condition of each part. In addition, a normal blood stream must pass through and supply it with nourishment, and there must be normal vessels through which to pump the blood. This seems a great deal to consider, but when the principal causes of disease of any one of these parts are classified, we find that the same causes affect many of the parts.

Physicians divide diseases of the heart into two

classes, functional and organic. What they mean by these terms is that when the heart beats too fast or too slowly, or even irregularly, a functional disease is said to be present. But if its size is too large or too small; if it is changed in shape; if the sounds are not natural; if the heart muscle is degenerated; or if the valves are shrunken or deformed, the abnormal condition is called organic disease. Thus the heart muscle may become thinner, thicker, or fatty; the valves may be open too much, that is, not closed completely; or they may be somewhat glued together. When they are too much open, the blood leaks backward; when grown together the opening becomes smaller and not enough blood goes through. This latter condition is called stenosis.

What then, in general, are the causes of heart disease? Some have heart disease from birth. Some acquire it as an after-result of infectious disease, either acute or chronic; or from putrefaction in the intestines; in either case from the bacteria themselves or from poisons (toxins) they make; some from bad habits of life, such as overeating or inactivity; some from physical strain; from interference with the circulation in the blood vessels; from the effect of the emotions; or from drugs.

Let us examine these causes more in detail.

Defects of the heart at birth are not of especial interest in connection with this book. Few having such defects live beyond infancy. There is, however, one continuing defective condition despite which a person may, with care, live for many years. In the infant's heart before birth is an opening through which blood flows, which should close shortly after its coming into the world. Sometimes this does not close, and those who live with this defect beyond babyhood become blue

with slight exertion. Nothing can be done to remedy the condition. Comfort and even life itself are merely a question of keeping motion within certain limitations.

Disease in any part of the body caused by bacteria, whether general or local, is always a menace to the heart. Such diseases are liable, also, to affect the lining of the arteries. By far the greatest number of cases of heart disease originate from some form of infection, often as an after-effect of such diseases of childhood as scarlet fever, whooping cough, diphtheria, rheumatism, pneumonia, or sore throat; and more rarely from measles. Much of the heart disease found in adults has its beginning with these childhood diseases. We find, also, in children, that heart disease is almost always associated with Chorea, called St. Vitus' Dance. In some cases inflammation of the lining membrane and disease of the valves results; particularly in such diseases as scarlet fever or rheumatism, in which the joints swell and one has fever. In other cases there is damage to the heart muscle, as in diphtheria. In this disease, before the use of antitoxin, many deaths occurred from heart failure.

Perhaps the greatest contributing cause of heart disease from the acute infectious diseases is a want of after-care, especially in school children. Absence of several weeks from school may mean the loss of promotion, and the effects of the disease upon the blood vessels and the heart do not appear until a considerable time after its onset; generally late in the convalescent stage, and frequently when the child is apparently well. The patient then is permitted to get out of bed too early, ofttimes to go out of doors and exercise. Not infrequently an infectious disease runs such

a mild course that the parents look lightly upon it. A physician is not employed and there is great danger of these after-effects.

In adult life we find acute infectious diseases still cause heart disease. At this period, however, influenza, pneumonia, rheumatism, typhoid and syphilis are more often the causes. Pneumonia acts in a double way. Not only may the infection give trouble, but the tissues of the lungs become swollen and a portion fills with an exudate, that is, material from the blood oozes out into the lungs, so much so that for the time being it becomes solid. The blood cannot pass through the affected portion, so it is dammed back. This makes increased pressure within the heart, and it may become dilated. Such a condition is one of the frequent causes of death in pneumonia. If the person so afflicted recovers from the pneumonia, then with proper rest and care the heart will gradually repair itself.

Very little reference has been made in these pages to venereal disease, and purposely so. It is necessary, however, to call attention here to the fact that very many serious and even fatal cases of disease of heart and blood vessels are due to gonorrhea or syphilis, particularly syphilis. Certain diseases of the heart and blood vessels come almost exclusively from the latter cause; as, for instance, aneurism. Aneurism is a soft pulsating tumor made by the dilatation of an artery.

Inflammation of any part of the body is characterized, as a rule, by four things: redness, heat, pain and swelling. These symptoms come, largely, from the greater flow of blood to an inflamed part. This increased blood supply is one of Nature's methods of remedying a diseased condition or injury. But the blood that passes through an inflamed part afterwards

goes to other parts of the body. So, if an inflammation is caused by bacteria, the poison made by the bacteria, and even the bacteria themselves, may be carried to other parts of the body, and may produce there irritation and inflammation. The toxins,—that is, the poisons the bacteria make,—are frequently very irritating and are liable to injure the lining of the arteries and of the heart. Sometimes the bacteria themselves, passing through the arteries, lodge in fine terminal arteries, to which there is no outlet, except the tissues. Such is the case with the arteries that supply the valves of the heart. The ends of these terminal arteries may thus become packed with bacteria, and serious damage be done to the valves. Fortunately, in many local inflammations, Nature walls off the inflamed area, so protecting the rest of the body. This we find to be the case in abscesses and boils. The pus is in the center, and a hard part, or wall is around it. Of late years it has been found that a local focus of inflammation may affect the heart, whether the inflammation has come on suddenly and acutely, or whether it is of slow formation and long standing,—that is, chronic. In the majority of instances the local inflammations that produce most cases of heart disease occur in the throat or the mouth—the tonsils or the teeth. Certain it is that sore throats and diseased tonsils are responsible for many, very many, cases of heart disease, and especially valvular disease.

So we see that disease of the heart may come from infection anywhere in the body, or germ disease. An infection by bacteria may be systemic, that is, one general disease of the body; or it may be focal, that is, a local point of infection.

Comparatively recent researches have brought to the

attention of the medical profession as never before the fact that many human ills come from or are made worse by putrefaction in the intestines, and the effect on the blood vessels of absorption of such materials. Irregularity of, or insufficient movements of, the bowels contribute to diseases of the heart and arteries.* Sometimes gases so dilate the large intestine as to push the heart and lungs out of place; and even heart failure has resulted from this cause.

A sedentary life and lack of exercise lessen the muscular power of the heart, and thus the muscle loses tone. The danger in such a case lies in putting an unusual strain upon the heart. The change from a sedentary to an active life should be gradual.

Moderate exercise strengthens the heart, but severe muscular effort may produce dilatation. Excessive dilatation may occur from the strain of physical work, such as lifting or carrying an object that is very heavy or of unusual weight; from a short burst of speed in running to catch a train, or in a hundred-yard dash; from mountain climbing, golfing, automobiling, which sometimes combines effort and mental strain from possible danger, or dancing. Especially bad is walking against a strong wind, as on the seashore or in a storm; rowing against the tide; or any great physical effort put forth to do some particular "stunt" in a contest.

One of the most dangerous of strains is swimming in very cold water, made worse by the swimmer's buffeting the waves. Here a different factor comes into play. It has already been explained to the reader how cold contracts the smaller arteries or arterioles. When these arterioles and other arteries are tightly contracted, their calibre is much lessened. For the

*See chapter on Movements of the Bowels.

heart to pump blood through these narrow tubes is a great strain upon its muscle, so much so that it sometimes gives up the struggle, stops, and the swimmer goes down. The newspapers, the next day, say he died from a cramp.

Especially is strain of importance in a heart that is already impaired, particularly so when the muscular wall has undergone degeneration. Death is often the sequel of even a slight strain after a prolonged siege of typhoid.

Much has been said of athletics and the results of athletics. It is well known from insurance statistics that athletes do not live as long as many others.

Habits of life, especially in the matter of eating, have much to do with the heart—late suppers—too much meat or cheese—an excess of coffee or tea or alcohol—frequent overeating. Obesity often severely affects the heart, especially if it develops a fatty heart, or deposits of fat near the heart, or in the abdominal cavity sufficient to displace the heart.

Insufficient rest and sleep are also predisposing causes of heart disease, as well as certain changes in the composition and quality of the blood, which affect the heart beat.

One of the great causes of heart disease at all periods of life is the effect of the emotions—worry, fear, anger, mental strain of any kind; and lastly drugs, such as headache-powders containing acetanilid or other coal tar products.

With so many frequent and common causes of diseases of the heart, it is not surprising that in the examination of school children, of recruits for the army, or of applicants for life insurance, we find one in every fifty persons having some form of heart disease. The

number of such persons in the United States is more than two million.

It has already been stated that every one should, occasionally, be examined physically to determine if any part of the body has become diseased or, for any reason, has suffered some injury. This is especially important in cases of heart disease; for the only way to live after contracting heart disease is to know fully the character of the injury to the heart, and to act accordingly. Many people die prematurely because they have not this knowledge.

A few years ago the disease people dreaded most was consumption, that is, tuberculosis of the lungs. It was then the custom of physicians not to tell their patients when they had this disease, because it was believed, in most cases, to be incurable, and the depression following such knowledge did much to advance the progress of the disease. But later it became known that this disease could be arrested, especially if recognized early, and if the doctor had the patient's full co-operation. So patients were told of their condition; and the nature of the disease, its extent, and the method of cure were fully explained. The patient was given hope, and many lives were thus saved.

It is now the same with heart disease. To avoid a fatal termination it is necessary to tell the patient the extent of the trouble, and to give full directions for its care, especially as regards work or occupation. We should always know the dangers ahead of us, and should learn whether our occupation conflicts with the necessary care.

The very name of heart disease fills some persons with great apprehension and fear, no doubt due to the knowledge that there are so many sudden deaths from

this cause. But many a person with heart disease, given proper care, may live to three score years and ten. In general, there are few diseases the treatment of which gives so much satisfaction to the physician as those of the heart.

The death rate from tuberculosis is declining. A few years ago its rate was the highest. That from heart disease has apparently been rising for fifty years, so that in some cities and states it is higher than tuberculosis. If these diseases of the heart are to be conquered, we must do as in the fight against tuberculosis —educate the public as to the causes, physically examine everyone, and tell the patient when he has heart disease, and how he may live with it.

A part of the increased number of cases of heart disease discovered can be accounted for by better methods of diagnosis. By diagnosis we mean the methods taken to recognize or know a disease. The older methods of knowing heart disease were by feeling the pulse; percussing the heart to tell its size (that is, laying a finger of one hand on the chest and tapping upon it with a finger of the other hand); and by listening to the sounds of the heart with the ear to the chest, or with a stethoscope. Of recent years, several instruments have been added: one that records the pulse; another that tells the blood pressure; the X-ray to see or to photograph the heart; and a still newer instrument that photographs and records the heart beat. Better methods, and more accurate diagnoses, do not account for all of the apparent increase in the number of known cases. We must search deeper. During the early years of our national life, physical labor was essential to the upbuilding of the country, and with it went wholesome, normal conditions. With the advent of vast commer-

cial opportunities have come keen competition, together with social and mental unrest, and we pay their price. Even with children, there is a wide gulf between the three R's of the country school and the extensive system of education to-day. Competition starts early in life. We outdistance our fellows at the cost of physical degeneracy. The unrestricted struggle to be first in worldly success brings physical ills that more than counterbalance the economic gains. In our high schools and universities, the physical strain in competitive games often leaves the health impaired for life. Many athletes are poor life insurance risks. Children and adults, rich and poor, alike suffer. With the well-to-do man disease is, often, the price of hazardous business undertakings; with the woman of the same class, of social advancement. But the farmer's wife and her city sister burn the candle at both ends to meet the increased demands of modern existence. With the poor, it is the never-ending struggle of poverty, insanitary surroundings, and hard manual labor. So the rise of heart disease, in recent years, has probably been due to our increasing habits of hurry; to the strenuous life, particularly our grasping for the almighty dollar; to our changing habits; and to the effect of our present existence upon our emotions. We have prospered greatly as a nation. We eat more food than is good for us, and therefore the kidneys must secrete more waste. We overwork them whenever we eat more food than we can burn.

Nor do we give ourselves enough time for the ordinary necessities of life. We do not go to the toilet as often as we should, that is, we do not empty the bowels when necessary, nor get rid of the secretions of the kidneys until we must.

And we overdo our pleasures as much as our work. Our complicated methods of living, the conquering of distance by railroads, ships, motor cars, aeroplanes, telegraph, telephone, wireless (we probably do four times as much in a day as our ancestors did), and the increased cost of living, with the constantly greater strain of efforts to increase the earning capacity—all these affect the heart. We will never lessen this high rate of heart disease until our lives become more simple. We already know it. How we grasp at a book like Wagner's "Simple Life." We read of it, we long for it, but we postpone the day for putting its lessons into practice.

There are, then, two things to consider in the prevention of heart disease. How may we prevent acquiring a diseased heart; and, if we are one of the two million with heart disease, how may we live with it and avoid growing worse?

To avoid heart disease we must have reasonable and proper exercise at all periods of life in order to strengthen the heart. We should never change suddenly from a sedentary to an active life. If one leads an active life and changes to a sedentary, he should cut down the amount of food proportionately, and at all times avoid overeating and getting too fat.

We should avoid infectious disease; but as this is not always possible, we must recognize the fact that after-care is very important, and we should not overexercise upon recovery. We ought to avoid great physical and mental strain, excitement or shock; we should sleep a sufficient number of hours; and never take drugs without the advice of a physician. In other words, we must lead normal lives.

To find out if heart disease has been acquired, all

boys and girls should be examined in school, especially before any competitive sports. Classes in exercises should be graded, and the weaker ones have special exercises. Students in training schools and colleges should frequently be examined. All persons should undergo periodic physical and medical examinations.

Chapter XXI

THE CARE OF THE FEET

The care of the feet is principally dependent upon the proper fitting of shoes, and so might well be considered in the chapter on clothing. But since no part of the body is so much abused as the foot, and since the foot bears the weight of the body, our efficiency and our general well-being depend much upon the care of the foot. Therefore, the consideration of this part of the body and of its coverings requires a chapter by itself. Primitive man did not wear shoes, the skin of his soles becoming so thickened that he did not need them, just as in the case of some uncivilized tribes today. Certain savage races deform various parts of the body by pressure; some deform the head, others the waist; some wear wire tightly wound around the arms or the leg, while many nations deform the feet. In this barbarous custom the Chinese lead, and probably the Americans come second. It is stated by one authority that 80 per cent. have foot troubles. This was not always so. Two generations ago, boots and shoes were not made in quantity in factories as they are today, but were made largely by shoemakers to order, and to fit a particular person. The shoemaker had pride in the fit and workmanship; while many that make the manufactured shoes of today are merely commercialists.

Much harm is done by present-day styles of women's shoes. The high heel placed forward to give the ap-

pearance of a short foot, and the pointed, narrow toe and thin sole are responsible for much pain and illness, and prevent many women from performing properly their daily work. But it is not only women who are at fault. The recent army records show that comparatively few of the men examined wore shoes that fitted them properly. Vanity, not the needs of the body, has much to do with the shape of modern foot covering.

Who does not know that cold or wet feet may produce illness? But who stops to think of the effect of high heels upon the nervous system? Or who knows that painful feet may produce indigestion, and may so fatigue the body as to render it liable to disease? Consider, also, how necessary physical exercise is to good health; and how much our efficiency in daily work depends upon our ability to walk well and to stand without discomfort.

Well fitting shoes mean much to those whose occupation demands prolonged standing or walking, such as barbers, salesmen, painters, policemen, postmen, bookkeepers, bricklayers, clerks, porters, motor men, dancers, and many others. And we have recently added to our list of ailments the chauffeur's foot and the golfer's foot. No army could succeed if its soldiers did not march well. More or less deformed feet are one of the most frequent causes of the rejection of recruits. Except in armies, the human foot has never received its proper share of attention.

The foot is made up of twenty-six bones, with many ligaments, muscles, blood vessels and nerves. These bones are connected by several joints, and are arranged in the form of two arches, one reaching from behind forward—from the heel to the ball of the foot—and the

other extending from side to side. So there are two distinct arches, one lengthwise and the other crosswise of the foot. These help to make the foot lighter and to give it strength. They afford better support to the body and make the step more elastic and springy. Because of the arch there is a lessening of the shock from alighting when we jump; much depends on whether we land on the ball of the foot or upon the heel.

The Arabs, proud of their horses, are also proud of their own feet, because of their high arches and consequently high insteps. These arches are so high that water will run under them, and high arches and insteps have always been considered marks of aristocracy. In contrast to the Arab, born with a high arch, we find the negro races generally are born with feet that are flat, so much so that the bare foot will often stick to a wet pavement. The foot becomes flat when the arch has fallen, and then, too, the heel protrudes in the back. That the arch may be kept up, it is necessary for its bones to have the support of the rest of the tissues—principally the ligaments and the muscles. Should the muscles become tired or weakened, and the ligaments stretch, then the arch may become lowered and the bones dislocated. These displaced bones, pressing upon blood vessels and nerves, disturb the circulation and produce pain, and this pressure and the resulting pain act upon the whole nervous system and affect the entire body, causing so-called rheumatic pains. A weakened arch and a flat foot may give rise to many general bodily disorders, such as indigestion, headache and neuralgia. Often to relieve pain, a person so afflicted holds the body in a distorted position, called by physicians posture distortion. In this

way flat feet are a cause of drooping shoulders, and of a wobbly or shuffling manner of walking.

The foot may become flat from any cause tending to weaken the arch. The ligaments are not adapted to prolonged strain, and may become weakened from long standing, as in the occupations already mentioned; by putting extra pressure upon them—carrying excessive loads; or from the increased weight of the body when overgrown or too fat. Ligaments and muscles may be weakened by disease, prolonged convalescence, rickets or too rapid growth; by injury in athletics, too much strain on one foot where one limb is shorter than the other, or by the pressure of badly fitting shoes. Improperly shaped, or badly fitting, shoes are responsible for most of the acquired deformities of the foot. The first signs of flat foot appear often in childhood, not alone because the child's shoes do not fit, but also because children are frequently taught by parents to turn their toes outward. In this position there is a tendency for the feet to flatten. We should walk as the Indians do, with the foot straight forward. Some think that deformities of the feet are inherited. It is found, however, that such deformities are rarely transmitted to the children. Healthy children are born with their toes straight, and in this respect all have a fair start in life. Being born with perfect feet, there is no good reason why the child should grow up with deformed feet; it is entirely a matter of education, and observance of the laws of health. Most diseases arise from human ignorance, or from neglect, and are not sent to us by God. Many anxious parents force children to walk too soon; and their shoes do not always allow for normal growth.

Most troubles with feet come from wrongly shaped

or improperly fitted shoes; too narrow, too short, too pointed, or too thin in the sole, or with high heels. The kind of shoes worn should vary with season and occupation, especially as to the thickness of the sole. One should have appropriate footwear for every sort of weather, and should cover the shoes with rubbers in rain or snow. Perhaps the most common deformity is the bending of the great toe toward the other toes, as the result of wearing a pointed shoe, which causes a displacement of the bones, or by failing to adapt the shape of the shoe to the shape of the foot. This may make a permanent and painful swelling of the joint. The great toe plays an important part in walking; yet we generally find it out of place. It should point directly forward, or slightly inward, and we should exercise much care to preserve its straight line and that of the joint at its base. Deformity here causes an inflammatory swelling of a little sac at the joint, thus causing what is commonly known as a bunion. The joint is out of place, and the bones have become permanently deformed, so that only a surgical operation will cure it. This condition may occasionally be improved by wearing something between the toes to push the great toe over toward the straight line again. This, however, is a matter for a physician to decide. When possible a specialist, called an orthopedist or a podiatrist, should be consulted. It is far better to prevent such a deformity than to try to cure it. It is, therefore, of special importance that the growing foot be not deformed.

Sometimes shoes are too short, thus injuring the nails, as well as the joints of the toes. Such injuries are often produced by high heels, which throw the foot forward and cause the toes to press upon and

crowd the hard leather of the shoes. Wearing high heels, the maintenance of an erect position causes a strain upon the knees, hips and spine. The muscles of the calf contract, gradually the bones become somewhat displaced, and a weak foot is the result. Laced boots often prevent the toes pressing against the shoes. When shoes are too narrow they create corns, or callouses beneath the foot at the point of pressure. The callous thus produced is nature's effort to shield the parts affected. Narrow shoes may cause the toes to over-ride one another. Painful feet produce irritability of mind. Tight or narrow shoes cut off to some degree the circulation of blood. Thus cold feet result, and in cold weather chilblains appear, though these are not always due entirely to the tightness of the shoes. Poor circulation in the foot and exposure to cold affect the whole system.

Chilblains are due to exposure to cold, and cause a feeling of burning and itching as well as shooting pains. In this case there is a change in the anatomy of the parts affected, involving injury to the nerves and especially to the smaller blood vessels. Those suffering in this manner find it necessary to give better care and protection to the feet, to wear woolen stockings in winter and proper shoes, so as not to let the parts suffer from cold. Patent leather shoes should never be worn in such cases.

Some suffer from gout, which can be cured only by dieting and general treatment of the system. The same is true of excessive and very acid perspiration of the feet.

Thin soles not only expose the foot to cold, but are dangerous in workshops, as they permit nails or splinters of wood to injure the foot. Some accidents

in industry are due to high heels, which cause unsteadiness in walking; and, when they catch in holes or grates, cause their wearers to fall. Nails in the shoe may injure any part of the foot, but usually and more especially the heel. They frequently are the cause of warty growths. Nearly all bad conditions of the feet are relieved by wearing proper shoes.

Look at the average American foot today, either man's or woman's, and imagine that same foot on a statue of Venus, or Adonis, or Mercury, or even in a modern painting of the nude! A healthy and well formed foot is today an exception: Instead we find all kinds of deformities. Beauty lies in respecting fitness and not in counteracting nature.

Few people wear proper shoes. To test this, stand on a piece of paper in stocking feet and trace on it the outline of the foot. Compare this drawing with the shape of the shoe worn. The shoe should be adapted to the shape of the foot; the endeavor should not be to adapt the foot to the shape of the shoe. Many shoes have but little suitability in this respect. Some shoes are broad where they should be narrow, and narrow where they should be broad. Others are high where they should be low, and low where they should be high.

Shoes should be comfortable when they are tried on and should be snug in the heel. To keep the big toe in proper position the inner edge of the sole should be straight. The heels should be broad and low, and the whole shoe should be nearly an inch longer than the foot.

The purpose of stockings (or socks) and shoes is to protect the feet from injury, dirt, cold, dampness and heat. But stockings and socks are sometimes worn or

torn. They should not be too short. On the other hand, if too long or too large, they will wrinkle, and in this way may produce an injury. Neither should they be either too thin or too thick. As to materials, opinions differ. Some believe in woolen stockings, others in silk. Wool or silk may be used in winter as both materials are warmer than cotton. Personally, I believe that cotton is the best for all seasons.

Stockings should be changed frequently, daily if the feet perspire freely. The feet should be washed every day, preferably at night, with soap and warm water, especially between the toes. To avoid cold feet, one should wash them first in warm water, then in cold water, just as with any other part of the body. This will make them more hardy. Care should be taken to properly dry them after washing.

Owing to the close relationship of cold feet to loss of resistance to disease, and to catching cold, much may be done to avoid such illnesses by hardening the feet. It is customary for people in the country to wash their feet in cold water, and even to rub them with snow in winter, in order to keep them warm. The nails should be kept short.

A few years ago the question of the influence of the feet upon health received a great deal of attention, because of the writings and lectures of a German priest, Sebastian Kneipp. Since that time, walking barefoot on the grass or over wet stones, or walking in newly fallen snow for a few minutes, has been known as the Kneipp cure. To those not accustomed to such treatment, it is best to commence going barefoot in one's room instead of outdoors. Later one may walk from fifteen to thirty minutes in the wet grass, or on the damp sand of the seashore, and then should imme-

diately put on dry stockings and shoes. As hookworm is acquired largely from going barefoot, it is not a good plan to allow children to go without shoes on country roads, especially in certain districts, which are infected with the hookworm.

Chapter XXII

HOW INSECTS CARRY DISEASE

We have already learned that there are several ways in which the various kinds of germs or bacteria that cause infectious diseases may be carried to and enter the body. We may get them from unclean hands, from unbrushed teeth, from the dust we breathe, from spray out of the mouths of others while they are talking, from spoiled food, from contaminated water used in drinking or in bathing, from cuts and wounds or the bites of insects. This last is a most important way in which disease germs may enter the body, from flies, mosquitoes, gnats, lice, ticks and fleas.

That a human being may get disease from insects was found out through the patient work and the heroism of a few physicians in different parts of the world; and fascinating indeed are the accounts of the experiments they made and the dangers they underwent. Some even lost their lives.

These earnest workers have shown that some of the most serious and also the most prevalent of diseases are always carried by insects. Thus, for example, malarial fever is always carried by a certain kind of mosquito; yellow fever by another; typhus fever by the louse; the bubonic plague by fleas; Texas fever by ticks; and sleeping sickness by the tsetse fly. Usually these diseases are transmitted by an insect biting a person infected with the disease and afterwards biting a well person. In this way, through the wound in the

skin, they carry disease from the sick to the well. Generally speaking each disease is carried by a different insect; usually one species, that is one kind of insect, carries one particular disease.

But some insects, such as house flies, carry diseases on their bodies, or legs, or in the waste matter in their digestive tracts. In this way they may carry various kinds of bacteria.

It is not necessary in this chapter to tell of all the diseases thus carried; but only to speak of the more common insects, and of such diseases as usually prevail in this country, or might readily spread here.

While protection against such pests is largely a public health matter, and should be cared for by the health officers of states, cities, or towns, there are some things that each person can do in self-protection if he understands the insect, the disease, and its transmission.

A common disease carrier in this country is the housefly. Flies are dangerous because they come in contact with people and with food. They breed from eggs, the female fly laying 120 eggs at a time. Usually in about 24 hours these eggs hatch out maggots; in about ten days they become flies; and in ten days more these flies lay eggs. We can easily figure the enormous number of descendants that come from a single fly which lays its eggs in the spring. By fall they will amount to millions. Flies breed in any waste, but principally in stable manure. They rest at night, but are on the wing most of the time during the day, and prefer the inside of the house, if it is not too dark. As already stated the housefly carries the germs of disease on its legs, and in its inside, and may with these germs infect the food of human beings. It may also infect

other flies. Flies carry the germs of typhoid, diarrhœa, and consumption, and in fact almost any germ. They alight on the waste matter in privies, pigpens, stables, and garbage cans. From these places they are attracted by the odor of cooking at meal time, and enter the kitchen and dining room, alighting and walking on food. They may thus carry disease germs to whoever partakes of the food. Flies like to feed around the eyes of sleeping children, and in so doing may cause ophthalmia, a serious eye disease.

They feed on sputum or expectoration from persons suffering from consumption (tuberculosis) and excrete the germs which cause that disease. A fresh fly speck contains many living germs. A well-fed fly discharges excrement more than twenty times a day.

What can we personally do to exterminate flies? We must, each of us, see to it that where we live no waste on which flies can breed is allowed to accumulate. If flies do breed in the neighborhood in which we live, we must screen the windows and doors of our houses, and also screen all food. We should not eat food that has been contaminated by flies. We must not go to summer resorts or to restaurants, or live in places where these precautions are omitted. If flies do get into the houses, every effort must be made to catch and kill them by the use of sticky fly paper, fly traps, swatters, and poisons. If we live in the country and must have a privy, we must see that it is sanitary, that the windows and doors are screened, that the seats are covered, that it is dark beneath the seats, that the vault has masoned sides, or that there is a pan or box containing sawdust or ashes which is frequently emptied. We must also do our duty as citizens by sustaining Boards of Health in their efforts to get rid of such nuisances.

There are many kinds of mosquitoes. Some make their home close to human habitations, others live in distant swamps and woodlands.

It is only the female mosquito that bites—so female mosquitoes are an annoyance, not only interfering with our pleasure, but also disturbing us in our work. They tend to make outdoor exercise unpleasant. They interfere with our proper rest and sleep, and thus unfit us for the day's work. When they are numerous it is necessary to screen the house, or to use nets over beds and cradles. These nets interfere with the proper circulation of air and with the cooling processes of the body. By overheating, they tend to keep both children and adults awake, and to produce illness. Mosquitoes often produce great discomfort at meal times, when people should be in a happy and contented mood, for irritability interferes with digestion.

Some mosquitoes transmit disease; that is, they carry disease from the sick to the well. Different diseases are carried by different species. Thus, malarial fever is carried by one kind, yellow fever by another. Both directly and indirectly, mosquitoes influence health, and therefore efficiency. They are thus of economic importance, not only because of the cost of illness, but also because of the cost of screening. Mosquitoes have a direct influence upon property values.

It pays to get rid of mosquitoes, and this can be done; but to do it, we must understand something of their life and habits. Mosquitoes breed only in still water, preferably in dirty water. They lay eggs. Some mosquitoes lay as many as 300 eggs at a time in the form of a raft. Such a raft measures one-eighth of an inch in length and can be seen with the naked eye.

Other kinds, like those that carry malarial fever, while they lay a number of eggs, lay them separated.

The eggs float on the water. Generally in about two days, depending somewhat on the temperature, the eggs hatch and become the larvae or "wigglers" so frequently seen in rain water barrels. These wigglers breathe air through their tails. They come to the surface every minute or so to breathe. If unable to obtain air at frequent intervals they die. In about a week the wiggler changes into a comma-shaped creature called the pupa, from which in about two more days the mosquito emerges.

To exterminate mosquitoes we must attack them in their breeding places. As mosquitoes breed only in water, we must remove or guard places where water collects. Tin cans, bottles, or any waste that may hold water should be removed. Tubs and barrels that are used to store water for household purposes should be covered. Roadside puddles, cup-like depressions in rocks, and holes in tree trunks or stumps should be filled. Old ditches should be cleaned, gutters repaired, cisterns covered or oiled, water pans for chickens or animals frequently emptied and cleaned. The edges of ponds should be kept free from grass. Marshes should be drained by ditching, and the material from the ditches used to fill in the pools. Where it is impracticable to fill or drain, kerosene or crude petroleum should be used to cover the surface of the water. This will kill the wigglers, as the oil shuts off their air supply when they come to the surface to breathe. It is generally stated that as fish feed upon the larvae or wigglers, ponds should be stocked with fish and also that certain birds and dragon-flies feed on mosquitoes. But these methods are insufficient, and such statements

generally obscure the real means of extermination, destruction of the breeding places. If necessary, legislative action should be secured to enforce the drainage of mosquito-breeding places.

Mosquitoes that enter the house may be killed by burning sulphur, and for this purpose one or two pounds should be used to every 1,000 cubic feet of space. As with flies, pyrethrum powder, or a mixture of carbolic acid and camphor are also effective. Windows and doors should be screened. Such preventive measures are making the tropics more healthful, and made possible the building of the Panama Canal.

Lice are common carriers of disease but are more frequent in Europe than in America. It has been known for a long time that typhus fever, now so prevalent in Europe, is carried by lice. They carry also relapsing fever, and it has recently been proved that trench fever, of which we heard so much during the late war, is due to them.

Lice are wingless insects having a stylet in the mouth with which they pierce the skin to suck blood. They breed by means of eggs fastened to hair or clothing, these eggs hatching in ten to fifteen days. It is said that a body louse will have five thousand offspring in two months. There are three kinds of lice, one kind living on the head, another on the body, and a third on the pubic region. Probably all carry disease, though the body louse is principally responsible for typhus fever. The prevention of lice depends upon personal cleanliness. They are usually transmitted from one person to another. Sometimes they come from beds, sometimes, with children, from exchanging hats. To get rid of them on the body or in the hair, use crude oil, gasoline, kerosene or turpentine. To kill nits on the

hair, use vinegar or alcohol, or use an ointment of mercury, washing the hair afterwards with tincture of green soap and water. Each person should use his own brush and comb.

Clothing in which lice appear should be disinfected. Underclothing should be boiled, and the seams in trousers and other clothing pressed with a hot iron.

Fleas are flat and have no wings, but possess the ability to jump from three to five inches. They breed somewhat like flies. The female lays her eggs in the hair or fur of some animal. As these are not fastened on the hairs as in the case of lice eggs many drop to the ground. They hatch in two or three days becoming larvae, like maggots, but without legs. In two more changes these become fleas. The complete development from egg to full grown flea, requires two or three weeks.

Their mouth is somewhat like that of the mosquito, but both the male and the female flea draw blood; whereas only the female mosquito is dangerous.

We come in contact with fleas principally through their infesting cats and dogs, but they may also infest other animals. They are very dangerous in some parts of the world because they live on rats and squirrels. It is the rat flea that is responsible for that most deadly of all diseases, the plague. At one time this disease had a foothold in California, and there seemed great danger that it would spread throughout the United States by means of ground squirrels, though this is questioned by some authorities.

To prevent disease being spread by fleas, it is necessary to get rid of rats, and probably many other small animals. This is a very difficult task, which we will not discuss here.

Bed bugs are found everywhere. They have flat bodies and no wings, and a very disagreeable odor. They usually live in cracks and crevices where they breed. They lay eggs which hatch in a week, though it takes seven weeks for them to grow up. They bite, draining blood through a beak. Bed bugs are probably responsible for several diseases; it is said that they carry leprosy.

As with fleas, the bite may be very irritating, and while not so much so as a flea bite, it is so annoying that one is liable to scratch it and make an infected sore. If a room is infested with bed bugs, it is well to disinfect it with sulphur, and to use in addition some insecticide, scalding water or corrosive sublimate, or to renovate the room, painting the cracks and crevices to fill them in. Where the sides and ends of beds join, and on the ends of slats, one should use kerosene, or some other preparation, and also clean around the edge of the mattress. The backs of pictures on the walls should be looked at and cleaned, as well as nets over beds, and particularly the edges of wall paper.

Ticks, gnats, and other insects also carry disease. To prevent this, it is necessary to keep the kind of insect that carries the particular disease under consideration away from any person already afflicted. If a patient has a disease that can be carried by an insect, we must see to it that the carrier of the disease does not get to him and thus spread the disease to others.

Chapter XXIII

THE INFLUENCE OF THE MIND OVER THE BODY

Human beings have given to them a body, a mind, and a soul. In a living person the body is the house in which the soul lives. So we may say we are composed of three parts: 1—The physical. 2—The spiritual or moral, and 3—The intellectual, mental or emotional. This last exercises control over the body both consciously and unconsciously. We generally speak of the body as controlled by the brain, but this is only partly true. It is controlled by the whole nervous system.

These component parts, which constitute the living body, are so inseparably connected that it is difficult to say where one leaves off and the other begins. The soul only reveals itself through the body to which it is united. This is one of the mysteries of life.

Some confuse the mental with the moral. The mental does not, of necessity, make us moral; a knowledge of reading, writing, and arithmetic does not in itself make people good. Such knowledge may be used either for good or for evil. And some may think, because the intellectual is linked with the physical, that disease of the body must affect the mind. It all depends upon the part of the body that is diseased. In general, a healthy mind exists in a healthy body, but it may also exist in an unhealthy body. Many persons wasted with disease have brilliant minds.

To understand body control, we must understand

something of the construction or anatomy of the nervous system. This is composed of several parts: the brain, with cranial nerves extending from it; the spinal cord, with nerves from it going around the body and extending to the arms and legs; and the sympathetic system, reaching to the internal organs.

The brain is in the skull. The spinal cord is enclosed in the backbone and is connected with the brain. The nerves from the brain are in pairs, one for each side. Among these are the nerves of the special senses: sight, hearing, taste, smell, and touch, so far as the head is concerned. One pair of these brain nerves passes down the neck and supplies the heart, the lungs, and the stomach.

Of both the brain and the spinal cord nerves, some carry sensation; others move the body and are called motor nerves. So nerves carry sensations of pain, touch, heat, or cold, to the brain, and also carry orders from the brain to the body.

The main trunk lines of the "sympathetic system" pass up and down alongside the backbone or spinal column. These nerves control the blood vessels and the internal organs and also communicate with the nerves of special sense and the rest of the nervous system. A local center of control of the sympathetic system is a network of nerves called a plexus. The best known of these is the large one in the abdomen, called the solar plexus.

The mind and the nervous system exercise control over the body, both consciously and unconsciously. The control is conscious when we exert our will-power. We are able voluntarily to do certain things when we wish to do them, for we have voluntary control of our muscles. We move the muscles at will. We walk, we work,

we stop when we desire. We talk, we eat, we swallow our food and drink, and at will get rid of waste materials from the bowels or the bladder. We can even hold our breath for a time.

Control by the brain and nervous system is unconscious when the body regulates itself. The heart beats, the blood flows through the blood vessels, the liver and various other glands and organs go on working. The gastric juice and other digestive fluids are secreted, and the building-up and breaking-down processes by which we produce energy and keep warm go on constantly. Each organ does its work whether we are awake or asleep, and without our even feeling these workings if we are in health.

We have also much voluntary control over our senses. Thus we look where we will; we read and study voluntarily. Thus also, taste and touch are much under control, though we cannot help hearing sounds or smelling odors unless we get away from them. The effects of the things we see, hear, smell, taste, or touch, which play upon our emotions, are only partly under our control. Some impressions received by us through our senses result in pleasurable emotions. Thus the sight of colored foliage, the smell of flowers, the touch of silk, the sound of music, the taste of sweets, all please us. Many other things that come to our knowledge through the senses displease or anger us, make us fearful, or disgust us, and sometimes even make us ill. These things, that so deeply affect our emotions and influence our actions, are primitive feelings that have come to us through thousands of years of inheritance and are born in us. They may be increased by our personal experience, or by early teachings.

After we grow up, the differences in our mental con-

stitutions depend a good deal upon the history of the child while the mind is developing—while it is being formed—the diversity of our experience during the period of youth. And it is quite possible by the judicious training of a child in early years to change habitual melancholy into habitual cheerfulness.

Of the feelings which are our earliest instincts, and which determine our actions, hunger comes first; and all through life the appetite for food or drink controls some people. Next come pain, anger, and fear. Then comes laughter, and then the desire to make a noise. These also are sometimes uncontrolled through life. Self-preservation is one of our most deeply rooted instincts. Later comes a knowledge of the difference in sex; and this greatly influences behavior. All of these are animal instincts. And human beings differ from the lower animals chiefly in their ability to gain control of their own conduct.

Our behavior all through life is affected more or less as the body gives way to impulses and animal instincts, or as it is controlled by the will. So the will is a means whereby we may escape from the influence of these forces. Its function is to govern the inclinations that arise within us. It is given us to overcome inherited and instinctive tendencies. Our body should be our servant rather than our master.

The sympathetic system receives and records impressions. This sympathetic system of nerves is under the influence of the secretions of certain glands in the body. These glands have no apparent outlet. One, in the brain, is called the pituitary; another, in the neck, the thyroid; and a pair, attached one to each kidney, are the adrenals. The secretion from each of these glands has a specific effect upon the body. Mod-

ern research shows that they exert a marvelous influence upon the physical life and upon mental development. They are the agencies that largely govern our conditions as regards healthy mental and physical activity.

As an engine responds to the governor upon it, the governor responding to the pressure of steam and increasing the speed or diminishing it, so the wonderful human machine responds to the secretions of its ductless glands, as the brain and the emotions set them into activity.

As shown by Cannon and by Crile, with emotional excitement such as fear or horror, adrenalin and probably the secretions of other ductless glands are thrown out. As a result, the blood vessels contract, the skin becomes pale, the mouth dry, so that the tongue cleaves to the roof of the mouth, the hairs rise, the lips twitch, the muscles tremble, the heart beats rapidly, respiration is hurried, and the pupils are dilated. There is a mobilization of energy-giving compounds, and the organs that do not immediately increase motor efficiency, such as the stomach, stop work. Not only fear, but anger, worry, jealousy, envy, grief and disappointment all influence such secretions, increasing the material in the cells for the moment, to be followed by exhaustion. So the body is fatigued by emotion just as by severe labor or excessive physical exercise. A knowledge of some of these effects of a mental disturbance is not new. For instance, the effect upon the skin. Three thousand years ago, in fear and in a penitential mood, the moving finger of David wrote: "For day and night thy hand was heavy upon me; my moisture is turned into the drought of summer."*

*Psa. xxxiv-4.

Frequent emotional stimulation exhausts the brain and may help to produce diabetes, or diseases of the circulation and of the organs of digestion.

It has been truthfully said that when stocks go down in New York the death rate from diabetes and diseases of the kidneys and heart go up. On the other hand, joy, love, and sleep reduce illness.

> "Joy, temperance, and repose,
> Slam the door on the doctor's nose."

And with a cheerful mind even the sight of appetizing foods affects favorably the secretions of saliva and the gastric juice.

One's mental attitude unquestionably determines in a large measure the secretions of the ductless glands, and consequently, bodily health. The effect of the mind is shown in various ways. Not only does the pleasurable sight of food make the mouth water, but vomiting may be induced by a disagreeable odor or by the thought of spoiled food. A telegram bringing bad news during the meal may cause acute indigestion. Laughter, weeping, blushing, shivering, and sweating may all be brought about or arrested by a mental act. So also may the functions of other internal organs be affected. The mind may alter taste, and many other impressions received through the senses. Thirst is often caused by fear, in the beginning of a battle; while in the excitement of victory soldiers become insensible to cold, or even to wounds that are not disabling. Often a toothache ceases in a dentist's chair. The kidneys are so affected by the mind that, when one is unaccustomed to speaking before an audience, his nervousness increases the excretion of the urine.

The state of mind of an invalid influences largely

his recovery from disease. Where the mind is cheerful and the patient can be influenced to believe that recovery will be speedy, the advance toward health is far more rapid than when one is of a melancholy turn. And again, where the patient makes up his mind with firm determination that he will get well, he usually does get well. Experimental research shows that even in surgical cases, healing may be retarded by the mental condition.

I once witnessed a case where a woman, advanced in years, went to bed, and announced the fact that she was going to die. No symptoms of disease could be found. Still she persisted in the idea, and within four days she died, apparently of no ailment except that her mind was made up to die; and die she did.

In certain islands of the Pacific, sometimes if a native has an enmity against another native, he prays that his enemy may fall sick and die. This soon reaches the ears of the other, and frightened at what he fears may result, he loses his appetite and commences to worry. Soon he grows thin, and noticing this, he worries still more, feeling that his enemy's prayer is coming true. People tell him that he is sick. He takes to his bed, refuses nourishment, and before long passes away. All this is caused by the influence of the mind over the body.

Even pain may be controlled by mental influences. We feel pain more at night than during the day, because in the stillness and the darkness there is nothing to divert the attention.

I was called on one occasion to see a girl suffering with cramps, who had previously on several other occasions had morphine administered hypodermically. Fearing that she would form the morphine habit,

I gave her a hypodermic of water, but she believed it was morphine. In a few minutes she became quiet, and shortly after fell asleep. I have no doubt in this case that the pain was real.

From some trivial circumstances people not infrequently imagine themselves very ill, and serious consequences ensue if they continue to believe it. Some years ago in a country village a woman, on waking up in the morning, found herself all mottled with green and red about the chest and arms. Believing herself about to die from mortification, she sent for one of her neighbors to witness her last agony. "Oh! Maria," she said, "see, I am mortifying." "Why, Sally," said the neighbor, "when did this happen?" "Since I went to bed last night," she answered, "I am dying, I know I am." "Why, Sally," said the neighbor again, "let me see," and, being of a practical turn of mind, she commenced to bathe the affected parts with a moist cloth, and was not a little surprised to find the discoloration disappear under the application. It seems that the good woman had gone to bed under a new quilt and, the night being warm, had perspired so freely that the colors had run and produced the discoloration. It is impossible to say what would have resulted had not the real cause been discovered, as the woman's distress of mind was evidently intense.

Many are the people in all parts of the world that are healed by faith, even in the temples of idols.

Most quackery is based on mental cures, and the quack frequently succeeds by his boldness, making the will to bear the ill. Many nervous diseases are cured by suggestion only. The force of the mind to ward off or cure disease is not used by physicians in the present day as extensively as it might be. Knowing the influ-

ence of the ductless glands, the modern practitioner cannot afford to overlook the influence of the mind. The most successful physician is he who can stimulate the will, and through it affect favorably the mind of the patient, combining this with scientific advice in right living, and the proper use of drugs and chemicals.

"The man of medicine should ever be
A wholesome man, if he would doctor me;
A man of hearty ways and cheerful eyes,
Who all depressing circumstance defies;
Who carries inspiration in his voice;
And in whose coming, life and health rejoice.
Ah! sad and sick, the suffering ones, who miss
The touch and presence of a man like this,
Whose thrilling magnetism and cheerful laugh
Add to the remedies their better half;
And reinforce the courage and the will;
And give sure virtue to the doubtful pill."

I would not, however, have it thought that I decry the action of drugs. They have their place, and the cure is not merely due to faith in the drugs. Their action, when rightly used, is indeed wonderful, their aid in the cure of disease often marvelous, as in the power of quinine to cure malarial fever. How often has the stimulating effect of one drug, or the soothing effect of another by relief from pain, helped to save a human life! Think of the result of drugs in the control of hemorrhage, their effect upon secretion and excretion, or in reducing temperature in fever. What would we do without digitalis to steady the heart; but what, on the other hand, would we do if we could not give the patient hope?

The cure by the mind is not new. Solomon in his collection of Proverbs says, "A merry heart doeth good

like medicine." Our health, then, is much influenced by our mind, and the control which it exercises over the body. So health and happiness depend much upon our mental attitude. It is a question of will, that power needed by men and women to endure the stress and strain of life. The mind should control the body; we must not let the body control the mind. Our inherent tendencies—hunger, appetite, fear, anger, worry, sorrow, disappointment—should be kept in abeyance. The shock of these feelings and their effect upon the body, may be deadened by drugs or by alcohol; but while such drugs are useful in the hands of a physician, to use them to forget worry is almost certain to induce the drug habit.

Success in life depends much upon our will power and the extent to which we develop it. It is developed in somewhat the same way as is muscular power—by exercise. If we wish a muscle to improve, we use it. So with the will; we first must concentrate our attention on what we wish or should do, and then do it. An act frequently repeated becomes a habit. Habits, continued, become automatic. When you have acquired the habit of self-control, then your life is your own, and you can say with Henley:

"I am the master of my fate
I am the captain of my soul."

So as a result of will control and development one may:

"Sow a thought and reap an act;
Sow an act and reap a habit;
Sow a habit and reap a character;
Sow a character and reap a destiny."

Nevertheless the will cannot be developed without training. The untrained soldier may lose self-control, and from fear run away in the face of danger; but he who has been drilled for long weary months until he has learned to obey, and has acquired the habit of doing what he is told, marches straight against the enemy.

We should not depend upon others, but learn to rely upon ourselves, and to make our own decisions. One of the greatest hindrances to self-control is vacillation. One must be positive, decisive, and then do the thing in hand, remembering that whatever is worth doing is worth doing well. "Whatsoever thy hand findeth to do, do it with thy might."* Remember that every repetition makes the will stronger. Particularly so if each day we do a task we do not wish to do. We must not simply wish, but will, and do.

In the course of everyone's life there comes at some time the consciousness of having been wronged by another. Anger, hatred and revenge are thus engendered. But these things, like fear, greatly injure our bodies, and particularly our rest and sleep. We must try to live in such a manner that we give no reason to anyone to wish to injure us. And under no circumstances must we allow such things to irritate us. Rather let us forget our injuries and grievances, as peace of mind and a serene spirit are worth more to us than revenge. Fear, worry, and anxiety, which are all the same thing, differing only in degree, seem to be the common lot of man; and some never get away from this burden. Some are untrained, others have lost the power to leave worries behind.

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*Eccles. ix-10.

Some of this worry comes from teachings in early life. Children are taught, both in song and story, to be afraid of the dark. They are told that some hobgoblin, or dangerous animal, will get them if they do not obey; or that for some slight fault punishment is to be anticipated, so that they live in fear and apprehension. Still others acquire from their parents the habit of worry, and later in life find control of self hard to obtain.

Worry is one of the causes of illness. I do not mean by this, great worries. It is the little annoyances and frets of life that spoil our comfort. We let the necessity of being continually alert, the constant annoyance of the telephone, and the stress of daily work give us nerve strain. Some worry about the future of their children; some about their business, and others about their household affairs. Some have visions of poverty; others dread illness. Some worry because another has made an unkind remark, or about some one of many matters too numerous to mention. Work does not hurt us in this country so much as worry. Yet there is so much talk of overwork that we are apt to be self-indulgent, satisfied with less work than we are really capable of doing. If our daily work moves without friction, this body of ours could stand a great deal more work without being injured. Most worries come from petty disturbances, on account of which many people allow themselves to become fretted and jaded, and unfitted for their duties. "The tests of life are to make, not break us. Trouble may demolish a man's business, but build up his character."*

Thomas Carlyle says: "Give me the man who sings at his work." One of the best cures for worry is work.

*Maltbie Babcock.

Physicians long ago learned that an excellent aid in the cure of chronic invalids who are morose, is to keep them busy. So occupations are devised for them. In work one may forget his troubles, especially if it is work he loves. "To business that we love we rise betimes and go to't with delight."* More especially is this true in the case of work done in the service of others. To give happiness to others is life abundant.

One of our greatest difficulties in life is that some of us do not properly plan our work, and we have no method. Another difficulty is that we cannot forget ourselves. And still another that we do not always realize that we cannot do everything.

There are just two things about worry to remember. First, there is no use worrying about the things you cannot help. Second, there is no use worrying about the things you can help: do them and get rid of the worry. It is one's duty to be happy. Several times we are told in the Bible to "be of good cheer." If we could only realize it, cheerfulness is one of the best kinds of medicine. Banish foreboding and anxious forecast, fill to-day with faithful work, with courage and hope, and you will make to-morrow brighter and better.

In the epidemic of influenza in 1918, there were many deaths throughout the country. The whole nation was excited and worried. Families at home were worried by the war news, about the young man who had gone abroad. The men in the army were worried about those left behind. Many in the army had never before been away from home, and they suffered from homesickness, fatigue, and depression. How much did this mental attitude have to do with the

*Shakespeare—"Anthony and Cleopatra."

death rate? Much, I am certain. Often before in other epidemics of disease people congregated in the churches, and found mental relief in prayer and in trust in God. But there were no such great assemblages in 1918. People trusted in science, and they failed to get that relief and assistance spoken of in Isaiah, "Thou wilt keep him in perfect peace whose mind is stayed on Thee."

So let us by force of will put aside worry, anxiety, grief, distress, despair, discontent, disappointment, discouragement, anger, and resentment—these things that do so easily beset us, and which spoil our digestion, uselessly use up our energies, and weaken our defenses against disease. Let us, instead, have expectation, hope, faith, confidence, joy, cheerfulness and love, all of which rest us and build up our bodies and help make us secure in time of sickness. Let us give utterance to that prayer of Whittier:

"Dear Lord and Father of Mankind,
Forgive our foolish ways;
Reclothe us in our rightful mind,
In purer lives thy service find,
In deeper reverence, praise.

* * *

"Drop thy still dews of quietness
Till all our strivings cease;
Take from our souls the strain and stress,
And let our ordered lives confess
The beauty of Thy peace."

Chapter XXIV

CONCLUDING WORDS

It is often said that he who doctors himself has a fool for a physician. The best advice that can be given as to the care of one's health, is never to dose one's self; for a person is unable to judge for himself as to the nature of his ailment. Even in the best of hospitals mistakes are made, and experienced physicians, who have at hand every scientific instrument that can aid them in diagnosis, sometimes err. From the symptoms disclosed they do not always recognize the true nature of the disease. How much less, then, can the inexperienced layman, who knows nothing of medicine, and whom his own feelings deceive, prescribe for himself? Moreover, what does he know of the effect of drugs? And such a one may, and often does, prescribe for himself a patent medicine; one which is manufactured to benefit no one but the proprietor, and of which the result to the purchaser is frequently disastrous. To dose one's self with anything, no matter what, is always ill-advised. In the event of illness, a physician should invariably be consulted, preferably one's family doctor, who, if need be, can refer the patient to a specialist of repute.

Seneca, the Roman philosopher, said: "Man does not die, he kills himself." Seneca knew that our span of life depends largely on our habits. Many acquire a diseased condition, which is not entirely curable, but which can be improved. The improvement may

result from forming new habits and from modifying old ones. How is that done? What habits shall we acquire and what ones avoid? How may we perform our daily tasks easily, normally, without curtailing the span of life, and, in particular, how may that span be lengthened? In the preceding chapters these methods are told. The observance of them will tend not only to prolong life, but to make those that practice them more active and more accurate in thought, and more useful to themselves and to others. Even though advanced in years, one may continue his usefulness.

It is related of Moses that his life was divided into three parts, that he lived to be one hundred and twenty years of age, and that "his eye was not dim, nor his natural force abated."* He might have lived longer had he not disobeyed the commands of his Maker, which he himself recorded. His best work was done in the latter half of his life, after the age of sixty. And it is true that many others have done their greatest work when past middle life.

We must, as we grow older, regard bodily comfort. If one should have a mole or a wart which may be irritable and painful, and which is unconsciously handled, one should have it removed; for any chronic point of irritation is apt to lead later to malignant disease. Is your life spent in an office? Then your chair should be comfortable. Is it soft so that pressure may not produce pain or sciatica or stiffness of the limbs? Is your room properly ventilated, so that no draft comes on the body? Does the light fall on your desk properly?

At no time in our existence, at no matter what age, should life seem burdensome. Even until old age,

*Deut. xxxiv-7.

persons may be normal. By that we mean that all parts of the body move and perform their functions easily, unconsciously and pleasurably.

It is quite possible for people to dispense with the usual inconveniences that attend old age, provided, of course, they have sufficient income for their needs; not as in Gray's Elegy, where

> Chill Penury repressed their noble rage,
> And froze the genial current of the soul.

Cicero in an essay on old age wrote that a certain Roman remarked that he "had no reason to complain of life." And this must be the attitude for those who would live long. There are many people who seem to regard life as a fit of sickness, or as is said in a hymn, "This vale of tears," to be got through as soon as possible. If instead, we could find continual happiness and see everything from the optimist's point of view, many of our problems that relate to health would be solved. And we may find much of this happiness, like the Creator of all things, in the creations we ourselves make; in our daily work; more still if we can but recognize the beautiful in the world, for

> Earth's crammed with Heaven,
> And every common bush afire with God;
> But only he who sees, takes off his shoes.*

Those who, like Weber, observe closely and study the manner of living of persons who have reached the century mark, find confirmation of the facts that I have presented. With but few exceptions, certain things have contributed to their long lives. First and foremost is heredity, a strong line of ancestors who

*Elizabeth Barrett Browning.

have lived long. In this respect, however, there have been some notable exceptions. Some who have lived long were not born strong, nor were they men of vigorous ancestry. Yet they reached the goal, for we may increase or decrease inherited resistance. We find, as a rule, such men temperate in all things, especially in their eating; that they rose early and lived in the open; that they worked hard, and led active lives. Few indeed have been wealthy. There have always been things that they wanted, but they were contented with such things as they had; and though many of them had no luxuries, they were cheerful and of happy dispositions.

As one advances in life there should, then, be moderation in all things, not too much to eat or drink, not too much exercise; moderation in work, moderation in pleasure. If we are not self-indulgent, we may calmly face the vicissitudes of this life.

Let me close with a few lines from Robert Browning's Rabbi Ben Ezra:

Grow old along with me!
The best is yet to be,
The last of life, for which the first was made;
Our times are in His hand
Who saith, "A whole I planned,
Youth shows but half; trust God: see all, nor be afraid!"

EPILOGUE

Science steadily advances in her conquest of disease. Great have been the recent discoveries in the origin of disease, and in methods of prevention and cure. But ignorance of the laws of nature hinders her progress. These laws cannot be broken without paying the penalty, for nature never excuses ignorance.

With the Psalmist let us say—"Give me understanding and I shall keep thy law." Therefore, having heard, "be ye doers of the word, and not hearers only."